# ELECTRICAL REVIEW

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

*(Formerly Review of Telegraph and Telephone.)*

Vol. 4, No. 18. WEEKLY. NEW YORK, SATURDAY, JULY 5, 1884. $3 per annum. Single Copies, 10 Cents.



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Entered at Post Office, New York, as Mail Matter of the Second Class.


**Schuckert's Works at Nuremberg.**

Among the sundry machines exhibited at Paris, in 1881, a few of Mr. Schuckert's were found; but, as they were exhibited by the firm of Krizik & Piette and Mr. James Pyfe, they were scarcely noticed. The machine, which was feeding Krizik's lamps, in the Austrian section, was placed by the side of Gulcher's machine, while the other machines, one of which was feeding the four lamps lighting the main stairs, were placed in Mr. Pyfe's exhibition.

People who visited the last exhibition at Vienna must have found a great difference. Mr. Schuckert's exhibition was one of the most important.

It was in 1873, when Mr. Schuckert, returning from Mr. Edison's place in New York, arrived back to Nurenberg. Having discovered that the Gramme machine, which had just been invented, was destined to have a great success, he purposed to build a large factory in the American style; but, failing to obtain the necessary means to put his ideas into execution, he was reduced to the construction of a small machine shop. The ardor which he had entered the building of dynamo machines was soon rewarded; he succeeded in constructing a few machines with Gramme's rings and lateral inductors. All those machines were constructed for galvano-plasty. The rings were generally coiled with two systems of wires, one being used to feed the inductors, while the other transmitted the current into the baths. That disposition has incontestable advantages for small installations, because the feeding of the inductors does not depend on external resistance.

We have seen one Gramme's galvano-plastic machine sent back from Hanover to Paris, because the baths being too small the external resistance was so strong that the inductors would constantly slip off the armature. That was the first Gramme's machine we saw, and, as the construction thereof was quite unknown at that time, we could not give any advice to the galvanizer; he was obliged to replace it with a Siemens & Halske's magneto-electric machine, which also represents the rather primitive construction.

When the electric light was first entering into use, Mr. Schuckert also constructed machines for arc lamps, after having altered the construction of his machine. Those machines were feeding Dornfeld's lamps of the Krupp's patent.

When, in 1878, Mr. Jablochkoff, by the lighting of the Avenue de l'Opera, gave the first impetus to the construction of machines for the division of light, Mr. Schuckert was one of the few who at first understood the superiority of the machines with continuous currents. The construction of several lighting machines was accomplished by him in 1879.

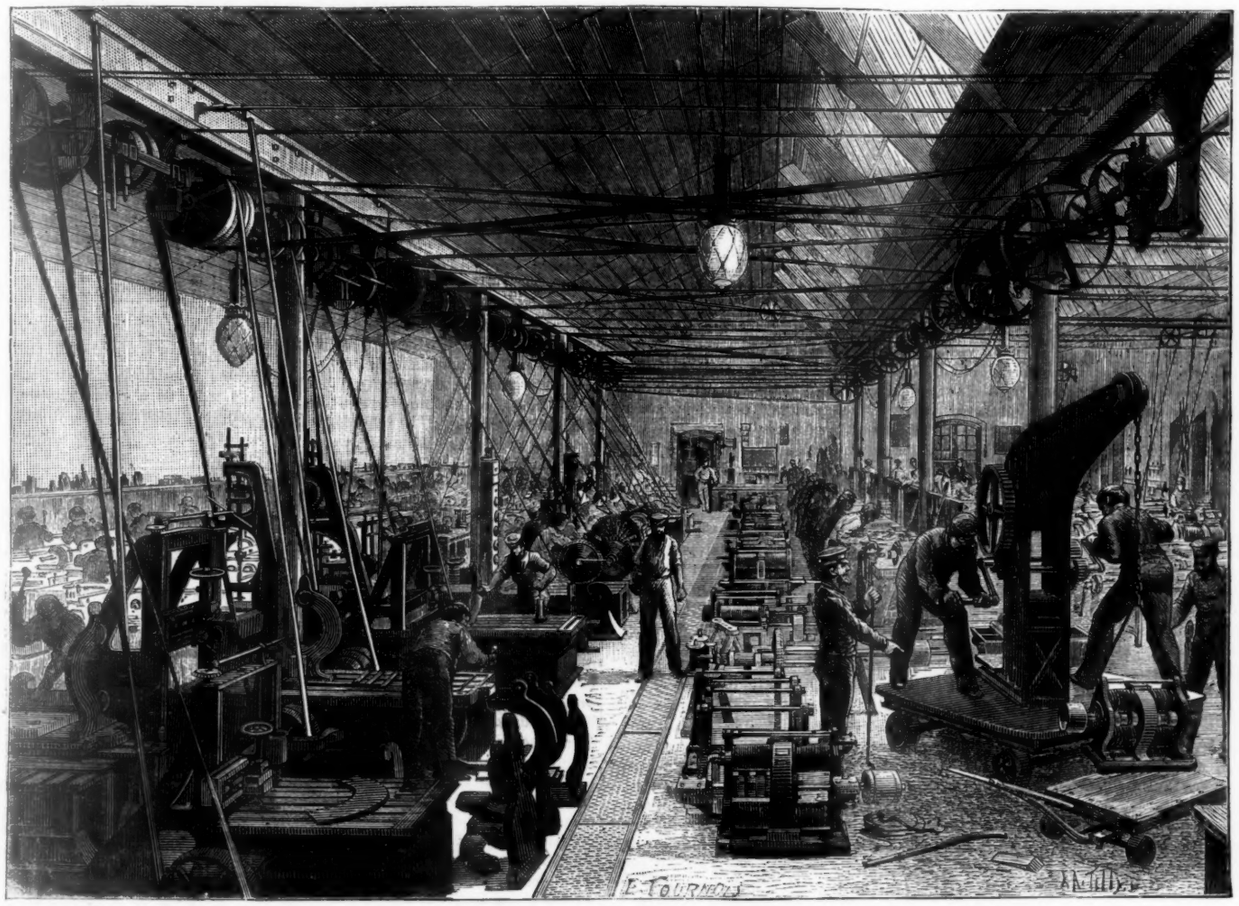
With such machines, Mr. Schuckert used the differential lamps of Mr. Krizik, the construction of which is greatly due to the practical knowledge and information of Mr. Schuckert. Towards the end of 1881 we made our first visit to Mr. Schuckert's works; his manufacture had already developed in a very encouraging manner. At that time the number of his employes and workmen was about 40. His works have since considerably enlarged. The number of his employes and workmen has now reached 160.

The building which, at the beginning, alone constituted the whole establishment, forms to-day only a part thereof, which is used for the construction of lamps and measuring apparatus.

The main part of the works is now represented by the large shop, illustrated herewith, in which dynamo-electric machines are constructed. A small railway is used therein for the transportation of machines and materials.

On the right side of the main shop is the laboratory, which is of a very recent construction. There are found Thompson's electrometers, sundry sizes of Siemens' galvanometers, Carpentier's ingenious resistance boxes, Kohlrausch's magnetometers, etc. It is altogether a real well-furnished scientific collection.

When we reflect that such manufacturing dates only from the beginning of 1882 (towards the end of 1881—Mr. Schuckert had not built more than 250 machines), we must acknowledge that he has made remarkable progress in the electrotechnic industry.—*La Lumiere Electrique.*



SCHUCKERT'S WORKS AT NUREMBERG, GERMANY.

### Electric Projectors on Board Yachts.

It is stated by our contemporary *Le Yacht*, that the Julie has, last summer, made a voyage in very intricate navigation, and by the use of an electric light condensed into a powerful beam, has been enabled to continue her course after dark, when otherwise she must have anchored, or run very considerable risks. The electric apparatus consists of a Gramme dynamo, of the type A B, giving a current of 25 amperes and an electromotive force of 50 volts. It is driven by a Brotherhood engine having cylinders 4 in. in diameter, and running at 900 revolutions. The two are mounted upon one bedplate fixed upon the bridge in a box, so that they are easily accessible and under perfect control. The installation weighs 1080 pounds, and was supplied by Messrs. Sautter, Lemonnier & Company.

A Mangin Projector is employed with an aplanatic mirror 15¾ in. in diameter. It is suspended by a block from the mizzen-mast, and is held by two branches jointed to the bridge, in such a way that it can sweep 270 degrees without the steersman being inconvenienced by the light. The lamp is automatic, of the Gramme pattern, and takes carbons of 13 mm. in diameter. The beam proceeding from the projector is very bright; under favorable conditions it renders objects visible at a distance of 2½ miles, and its intensity may be placed at five million candles, when in its most concentrated form. It can, however, be spread over a wider field when desirable.

The Julie entered the basin at Ostend at 8.45 P. M., on July 14, 1883, and then the light was set in action. By its aid, as no pilot was to be found, the vessel was steered between the moles, and right up the center of the channel into the harbor, although no one on board was acquainted with the navigation. On the 20th she left Rotterdam at two o'clock to go to Amsterdam by the Yssel and the Amstel, through the fertile country of Gouda. The canal was entered at seven o'clock, and its difficult navigation commenced. The shallowness of the channel, and its numerous turnings greatly interfered with the progress, while at each sharp corner the steam capstan had to be employed. At 9.30 the electric lamp was lighted, and thanks to its illumination, the voyage was continued through more than twenty bridges and locks, without any accidents, to Amsterdam. A somewhat grotesque phenomenon was noticed The animals in the pastures upon the borders of the canal awoke and stared at the vessel, and in their eyes there was seen the reflection of the light, which took different tints according to the kind of animal. At certain times it seemed as if they were the signal lights of boats approaching in the opposite direction. The vessel left Amsterdam at 8 P. M. on the 27th by the North Canal, whose dimensions recall those of the Suez Canal. At 9 P. M. the lamp was lighted, and the beam being elliptical, the two banks were illuminated for a hundred yards before and behind the bows.

In every case the employment of the electric light was a success. In the previous summer Mr. Gaston Menier found many instances, in the course of a cruise on the coast of Normandy, where the electric light was most useful, if not indispensable, as in the entry of ports, and the navigation of tortuous channels, and the like. The state of the sky has an important effect upon the penetration of the light. A calm, dark night is the most favorable season, and any general illumination in the atmosphere diminishes the intensity proportionably.

The eye perceives an object by the light which is reflected by that object. In the case we are considering that object receives and reflects the light of the luminous source, and the light diffused in the atmosphere. The object, therefore, should be the more visible the more luminous is the atmosphere, but, as a matter of fact, it is the contrary which happens. In reality our eyes behave like lenses; they perceive all the light reflected in the field of vision, and that in proportion to the surfaces illuminated. As the object occupies but a very small extent of the field of view of our eyes, the light which it reflects finds itself swamped in the light emitted by the atmosphere, and which, although feeble, acts over the whole area of the eye. It results that when the atmospheric light is augmented it acts over the whole circle of vision, and consequently more powerfully than the intensity of the light reflected from the illuminated object.

From a military point of view, this fact is important, because it admits of torpedo boats being discerned at a greater distance on a dark night, whereas on a bright night they will be seen later. The state of the weather makes a great difference. The slightest fog diminishes greatly the visibility, because the vesicles become lighted up and diffuse the rays, putting the observer under unfavorable conditions. In any case the electric light is a most valuable agent, even if it does not furnish absolute safety against night attacks.

### A Criticism on Telpherage.

Our contemporary, the *Engineer* (London), has the following to say on the above subject:

"Something has recently been heard concerning a system of transport, which has been termed 'Telpherage,' by Professors Jenkin, Ayrton, and Perry. We use the word under protest, and regret that it should stand a chance of becoming part of the English language. On the 14th of last May, Prof. Fleeming Jenkin read a paper on the subject before the Society of Arts, and he began by defining and defending the word It is 'intended,' he told his hearers, 'to designate all modes of transport effected automatically with the aid of electricity. According to strict rules of derivation, the word would be telephorage; but in order to avoid confusion with 'telephone,' and to get rid of the double accent in one word, which is disagreeable to my ear, I have ventured to give the new word such a form as it might have received after a few centuries of usage by English tongues, and to substitute the English sounding 'telpher' for 'telephore.' Two Greek words are used here as derivatives, namely, we presume, τηλε, far, and φερω, to bear or carry along; and if the word is to be used at all, it should be written 'telepher' or 'telepherage,' not 'telephorage;' and the way in which he has used this word in the passage which we have quoted almost leads us to think that Prof. Jenkin has confounded the roots of 'telephone' with those of 'telepher.'

"The system may be briefly described. Small iron rods stretched from post to post constitute an elevated railway on which run little carriages, from which are suspended buckets. The carriages and the buckets are propelled by small electro-motors which pull, by virtue of the adhesion of their driving-wheels to the rail, much as an ordinary locomotive does. Electricity is supplied by a suitable dynamo and a steam engine. The invention has been practically tested with a certain measure of success. A company has been formed to work it; and Messrs. Easton and Anderson, of Erith, are now engaged in manufacturing a plant for South America, under Prof. Jenkin's patents. It will be understood in a moment that the idea involved is in no sense novel. Everything depends on the way in which it is reduced to practice, and there is almost unlimited scope for invention in doing this. The mechanism devised by Prof. Jenkin and Mr. Jameson, his assistant, is extremely ingenious, and, so far as can be seen, very carefully thought out, and well calculated to meet the end in view. It is, we think, to be regretted that Professor Jenkin spoke more strongly as the advocate of his inventions than is quite consistent with the dignity of the position which he holds; and Professor Forbes was not slow to point out, in the course of the discussion which followed the reading of the paper, certain weak points in the system, concerning which its inventor had maintained, as we think, an indiscreet silence. The truth is, that Professor Jenkin is now entering on a very perplexing and difficult undertaking, and nothing but an extended experience will provide him with the means of overcoming great difficulties, mechanical and electrical, which he has to surmount. One or two we may refer to here.

"Wire rope railways or tramways have been in use now for many years. In the South African diamond mines, for example, they are used to such an extent that it is hardly a figure of speech to say that there are enough of them to darken the air if they were hung high enough. The most ingenious and elaborate thing of the kind ever brought out was Hodgson's wire tramway, and a record of his progress from the first crude idea to the elaborate system which he ultimately developed would be found immensely instructive by Prof. Jenkin, who is now going over a good deal of ground already traversed by Mr. Hodgson. There are two methods of working. Under one the whole line of wire travels; under the other the rope is at rest, and the bucket carriages run on it. Now, it was very soon found by Mr. Hodgson that it was absolutely necessary to have terminal stations and shunting arrangements, and these have to be much the same, whether the line is long or short. We notice that Professor Jenkin seems to regard such things as incidental luxuries more than absolute necessities. Under the Hodgson system the shunting was worked almost entirely by hand. Professor Jenkin proposes to use electricity, with a potential of 800 or even 1,000 volts; and it is evident that, this being the case, considerable risk will be incurred by those handling any part of the apparatus, unless special precautions are taken to protect the shunters. The greatest mechanical difficulty of all was found to lie in securing sufficient adhesion in bad weather to enable the loads to be carried up steep inclines. The rope slipped through the hook carrying a bucket. This bucket was then overtaken by another, and in a very few minutes half-a-dozen found themselves together, and by overweighting the span of rope on which they were, they caused it to sag, and, of course, augmented the incline, and general disorganization of the traffic ensued for the time. Professor Jenkin proposes to get over this difficulty by making his driving-wheels grip the rail precisely as Mr. Fell made his mountain locomotives to act on the Mont Cenis Railway; but Prof. Jenkin had to say that this involved him in difficulties. 'The grip,' he told his hearers, 'was so powerful that the rollers were capable of supporting the weight, and thus a small inclination of their vertical axis was enough to cause the locomotive to rise, and even run off the line; moreover, the vertical curvature in the rope, or at the posts, required the rollers to be deep, thus limiting the extent to which rocking was admissible; moreover, very broad pulleys fore and aft would be required even for moderate horizontal curves. Nevertheless, this locomotive ran sufficiently well on the one-inch line during an exhibition to the shareholders last Autumn.' In the new locomotive for the ⅝ in. line, we understand that the difficulty has been got over, but only, we fear, by a sacrifice of that gripping power, which is essential to success if the line is to be worked to empty the holds of ships or in a mountainous country.

"The details of construction are not too simple. The double line—one up the other down—consists of steel bars ⅝ inch diameter, welded to brackets, which are bolted to posts fixed in the earth. The locomotive draws, as we have said, a certain number of carriages after it. How many must depend on the incline, the insulation of the road, and the transmission of the current through the electro-motor. The rails up and down constitute 'two continuous conductors not joined to each other. So long as no train bridges a gap no current flows; but whenever the train bridges the gap a current flows from the positive to the negative pole round the motor. This plan is called the cross-over system; all the trains are joined by it in parallel arc, and the current is reversed each time a train passes a gap. This reversal does not affect the working of the motor. This is the plan which has been carried out on a large scale at Weston. Its simplicity leads me to believe that it will be the plan most usually adopted; but several other methods of driving have been devised. A spark passes between the wheels and the line each time the current is stopped; but this spark occurs between large masses of metal, where it appears to be harmless; it has given no trouble whatever at Weston. Moreover, it has been found very easy to make connection between the line and the train. The ordinary truck wheels answer admirably, so that no complicated brushes are required. There are some absolute advantages in having interruptions at regular intervals, but the discussion of these would lead me too far for my present purpose. Only one of the two continuous conductors requires to be insulated; this results in alternate insulated and uninsulated sections all along each line.' Professor Jenkin described the system of insulation adopted, which is expensive, and can no doubt, as he hopes, be superseded by something much better.

Up to this point all is comparatively plain sailing. Given a dynamo and a motor and a railway, transport can be effected. Now comes the question, how much? Professor Jenkin admits that there will be a very large loss of useful effect, but we agree with him that this is quite a secondary consideration. Where such lines will be used a little more or a little less waste of power will be of small importance. But it is of the very greatest importance that the road shall be able to carry a great many trains. If it does not, then its utility would be too much limited to render it advisable to adopt telpherage. It will be understood that the dynamo being at one end of the line, each motor on that line will absorb a certain amount of electrical energy. The number of amperes sent through the line will, of course, remain unaltered, if there is good insulation, but the volts will decrease. The motors will be virtually in just the same position as so many arc lamps in series. Professor Forbes pointed out that unless special precautions were taken the cars would run into one another. 'One would expect,' said Professor Forbes, 'that the electro-motive force would fall off so much between the near train and the distant one, that the near one would overtake the other, and that even an attempt to equalize the resistance of the circuit through each train by a return wire would not be completely satisfactory; and that even with such a device there would still be such a difference of electromotive force as would tend to make one train pick up the other.' He should be glad to know, therefore, if several trains had been run on one line. This had been done on an electric railway, where the same difficulty occurred, the only case which had come under his observation being the one at Vienna, but there the conductors of each car had the power of interposing resistances, so as to diminish the power, if required. In the case of arc lamps, it is possible, by the use of a high resistance shunt circuit, to make each lamp regulate itself independently of its fellows, and no doubt the same principle must be applied to the telpher locomotive."

### Saving Money by Saving Steam.

So long as the wheels of the machinery turn round at the appointed times it does not seem to occur to some manufacturers that they need give any thought to their boilers and steam engine.

In his earliest experiments Watt was surprised at the vast quantity of steam which a small engine used, and finally stopped it altogether, keeping up the steam pressure, and found that he could not see any difference in the consumption of steam, whether the engine was working or not.

Of course, such leaks as the one cited do not often occur nowadays, but it is a fact that many tons of steam, and the coal to make it, leak through engines daily where no one suspects it.

The greater first cost of a good engine, well fitted up, often prevents its purchase, but the coal bill would be enough reduced in a year to pay the extra cost.

The value of careful tests of engines and of the conditions under which they work most economically cannot be over-estimated.

At the coming International Electrical Exhibition, to be held at Philadelphia, September, 1884, it is proposed to make a most thorough series of tests for all engine builders who may make application for them.

### An Improvement for Carrying Electrical Conductors.

The introduction of the telephone has come to be regarded rather in the light of a necessity than a luxury. In view of such a fact eulogy becomes unnecessary, therefore we shall confine ourselves to the consideration of a few shortcomings for which the telephone is held responsible.

The ordinary subscriber allows æsthetic regrets to trouble him but little. On the matter of shortcomings he asks indignantly why his telephone should disclose his secrets to others; why should an inoffensive-looking instrument like the telephone subject its users to such frequent frights by way of startling effects?

While attempting to devise a remedy for an evil it is as well to trace its source. Now the source of telephone troubles is not, as is so generally imagined, always in the instrument, but is, as a rule, found to exist in the lines.

One of the effects of a current of electricity along a wire is that, during its passage, the wire exerts an influence upon all other wires in its neighborhood, even though they be a considerable distance apart. This effect is described by electricians as induction. Unfortunately, the telephone, being so sensitive, not only translates the sounds intended for its own wire, but actually translates, by these effects of induction, the messages going through other wires which are not intended to be overheard. In case of actual contact between lines the effect is necessarily more marked, and is, of course, more easily remedied, since it requires simply the clearing of the wires.

To a business man, however, the inoperation of his telephone for a few hours is no light matter, and as with the increase of lines such troubles multiply in geometrical progression, it is well to draw early attention to the matter. If it be any consolation to have partners in trouble it may be gratifying to know that we are not the only sufferers.

In England, America, and elsewhere, this question of telephone troubles is being seriously considered. A system of underground conductors has been advocated. This would satisfy the artistic amongst us, but we fear its great expense and the inconvenience to public traffic involved in the frequent additions to lines for new subscribers, and repairs to wires, render it impracticable, as the street or footway must be torn up to connect branch wires where required. We have, therefore, to devise some expedient to meet the increase of lines, and this very important matter has engaged the attention of electrical engineers and electricians for some considerable time, and one of the characteristics of the age is the rapidity with which a want once felt is supplied, and these telephone troubles prove no exception to the rule.

Mr. E. C. Cracknell, of Sidney, N. S. Wales, comes forward in the present strait, and has designed a system for carrying through our thoroughfares an aerial cable system, which does his skill and taste much credit. It consists of cast-iron standards carrying an ornamental cast-iron open-work frieze, behind which are racks for carrying the cables, each cable containing fifty conducting-wires, and from the very multiplicity of wires, and their mode of connection, the electrical disturbance from induction and leakage from wire to wire is eliminated. Mr. Cracknell has not only overcome one of the greatest difficulties of the day by getting rid of the unsightly and cumbersome system of carrying telegraph and telephone wires overhead, but he has struck at the very root of all our telephone evils, and it is said that the Government has sanctioned, and the Municipal Council approved of, the erection of Mr. Cracknell's system for carrying cables between the General Post Office and the Redfern railway station, along George Street, Sydney, Australia, for which tenders will be called without delay. There is another great advantage with this system, that the ornamental iron-work can be roofed over, so that shop-keepers can utilize it for verandahs, which will be of a uniform pattern of great neatness, instead of the unsightly and dilapidated awnings which now disgrace our sidewalks, and the fire brigade will be no longer inconvenienced when it becomes necessary to use their escape ladders for saving life, which the present accumulation of wires renders almost impracticable.

For the road crossings the cables will be protected by passing them through vulcanized rubber tubes to prevent their injury from sewage matter, and then placed in cast-iron pipes designed expressly for the purpose, so that additional cables can be drawn through as required.—*Electrical Review, London.*

### New Views on the Construction of Aneroid Barometers and Manometers.

Some time ago, the Commission for Standard Weights and Measures in Berlin interested itself in trying to find a barometer or manometer for the determination of the pressure in the receivers of their vacuum scales, in which the use of mercury could be avoided. This was considered desirable, because it had been found that at ordinary temperatures the tension of the vapor of mercury was so appreciable as to cause a perceptible error in the determination of pressure by columns of this liquid. Only aneroids could be considered, and it was doubtful if, on account of the well-known inadequacy of this instrument to give the accuracy required, a satisfactory result could be obtained even from a whole series of the manometers, though they had been previously compared with a good standard mercurial barometer. The accuracy demanded in fine measurements of weight is very great. That now attainable in comparative weighing of a kilogram of quartz with one of platinum is $\pm 0.01^{mg}$, and this requires an accuracy of $\pm 0.02^{mm}$ in the determination of the air pressure. This is an accuracy which can be attained by the best mercurial barometers only by the greatest circumspection in observation and most laborious reductions with use of the theory of errors. A precision of $\pm 0.1^{mm}$ has been considered sufficient in aneroids, and, with this, the index error was left to be obtained by comparison with the mercurial barometer, and changes due to temperature were entirely neglected.

The investigations attempted by the Commission for the purpose above indicated were intrusted to the best makers, but led to no favorable results. Meantime, the results of the investigation have lost their direct interest to the Commission, as it has been discovered by Ernst B. Hagen and by Hertz that at ordinary temperatures the tension of mercurial vapor may be considered infinitesimal.

In inspecting the ordinary aneroid, the most striking feature is the remarkably small amount of motion in the vacuum box. It has been found that in the most perfect instruments, at the most, only $0.01^{mm}$ for each millimeter of the mercury column; in the most of the instruments it was far below this, and in some it was less than $0.001^{mm}$. This small motion in the box requires, for accurate observation, very great mechanical or optical enlargement, which of itself introduces many and sometimes large errors. Indeed, when the motion is less than $0.001^{mm}$, while it is required to accurately observe fractions of this magnitude, the requirement of accurate observation may be considered unattainable. That in this state of the case the aneroid is as efficient as it is found to be, shows the care employed in its construction and is much to the credit of the manufacturers. The perfection of Naudet's mechanical transfer appears to me, from this point of view, worthy of the highest admiration. As is well known, the elasticity of the box could be made to give, under favorable circumstances, twenty times as much motion as is found in the best aneroids. A round corrugated sheet of metal 10 cm in diameter can be bent either way a distance of $3^{mm}$ without danger of permanent change of form. By putting two such sheets together to make a box, the entire motion from most concave to most convex would be $12^{mm}$. If the measureable variation of pressure is very small, as in a stationary barometer when the distance need not be more than $60^{mm}$, it would be possible, if the entire motion of the box could be made available for this interval, to have each millimeter of the mercurial column correspond to $0.2^{mm}$ in motion of the box. This is a magnitude twenty times as great as the maximum motion above mentioned, and is large enough to make it possible to measure its tenth parts, as is required by the Commission.

The cause of the smallness of the motion of the box in ordinary aneroids is found in the unusual strength of the spring required to enable the box to support the pressure of the atmosphere. In stationary barometers the spring must support a pressure of from 30 to over $50^{kg}$; the small changes in this load produced by variations of pressure are not strong enough to deform the heavily loaded box. A round plate uniformly loaded and supported at its center and edges—the case with the aneroids—will, as can be easily shown, have two-thirds of its load on the circumference and one-third on the middle. A box of two plates has on its spring a pressure of

$$2 \times \tfrac{1}{3} \times 1.03 \times \frac{\pi d^2}{4} = 0.5394 d^2$$

in kilograms. In this, $1.03^{kg}$ is the pressure at $760^{mm}$ of the mercury column on each square centimeter; $\pi$ is the ratio of the diameter of the circle to the circumference, and $d$ the diameter of the box in centimeters. In our illustration, if $d=10$, the spring would have to carry a pressure of $54^{kg}$ in round numbers. But the change of pressure by a variation in the mercury column of $\pm 30^{mm}$ would be but about $\pm 4$ per cent. of the above magnitude or $2.16^{kg}$. Assuming that the box is held by the spring in its mean place by a mean pressure of $760^{mm}$, the addition of $2.16^{kg}$, representing the greatest pressure, must press in the spring $6^{mm}$ in order to move each plate $3^{mm}$. An additional difficulty is found in the fact that the resistance of the spring increases with increased bending. When the pressure of the air decreases, in which case the spring expands the box, the force of the spring decreases with the decreasing demand on it, while for these purposes exactly the opposite is desirable. The property of the spring of giving a greater resistance to increasing, a less to decreasing, demand on it, is in this case as unfavorable as possible. From this standpoint we may designate as an improvement the employment, made lately by W. Lambrecht, of Göttingen, of suspended weights in the place of springs. They, at least, have uniform action.

The strong springs of the aneroids have another source of error, and that is the great tendency to alterations in their elasticity, to which they are subject, notwithstanding the care exercised in the material employed. The weight is superior in this respect. Finally, the great demands made on the knife-edge suspension of the spring are bad, in that its increasing blunting introduces error, aside from the inaccuracies produced by irregularities of form which must occur unless the greatest care is used in the construction.

From the above it would seem desirable to omit the spring and give the corrugated plates enough strength to enable them alone to carry the pressure. This was tried for a time in Goldsmith's aneroids, but it does not seem to have been preserved, and lately it has been tried by J. D. Möller, in Wedel, Holstein.

### Memorial Library of the International Electrical Exhibition of 1884.

HALL OF THE FRANKLIN INSTITUTE,
PHILADELPHIA, U. S. A.

The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, founded in 1824, has appointed the undersigned a Committee on Bibliography and has requested them to obtain for exhibition as complete a library as possible of all publications pertaining in any way to electrical science, up to the date of the International Electrical Exhibition, which will be held in Philadelphia, under the auspices of the Institute, from September 2d, to October 11th, 1884. This collection will be properly catalogued and exhibited, and afterwards placed in the Library of the Institute for permanent reference, as a suitable memorial of the state of electrical science at the time of the Exhibition, and will be known as "The Memorial Library of the International Electrical Exhibition."

As complete a classification as possible will be made of this library, and a printed catalogue thereof will be issued. It is especially desired that copies of all original papers on electrical subjects be obtained, and the committee therefore will be pleased to receive from you a copy of any publications, papers, reprints of articles, or notes on or relating to electricity, which you may have issued, and will see that the same are properly exhibited, and that due credit is given you for your gift.

ISAAC NORRIS, M.D.,
EDWIN J. HOUSTON,
WILLIAM H. WAHL.
April, 1884. Committee.

Parcels may be sent, suitably addressed, either to the care of Fred'k Ransome, Esq., Rushmore Lodge, Lower Norwood (Surrey), London, who is authorized to receive the same; or to Committee on Bibliography, Franklin Institute, Philadelphia, U. S. A.

### On a Mercurial Galvanometer.

A mercurial manometer is placed between the limbs of a fixed magnet in such a manner that the two poles of the magnet may be found to the right and the left of the horizontal branch of the manometer.

The electric current to be measured is led to the mercury of this horizontal branch, which it traverses vertically, *i. e.*, perpendicularly to the axis of the tube. There is then produced a difference of level between the two branches of the manometer, a difference proportional to the intensity of the electric current. In the instrument which I have the honor to present to the Academy, this difference of level is equal to 62 millimeters for one ampere.

The system formed by a mercurial manometer placed under the influence of a magnet constitutes, therefore, a galvanometer of a very simple construction, the indications of which are exactly proportional to the intensity of the current. The theory of its action is as follows: the portion of the mercurial column traversed by the current represents an element of a movable current. This element of the current tends to repel the magnet placed near it, in a direction determined by Ampere's law. As the magnet here is immovable, and the element of the current is movable, this element is displaced. The reaction which it undergoes produces a hydrostatic pressure, which is shown by the alteration in the level of the mercury. The mercury stops as soon as the hydrostatic pressure comes into equilibrium with the electro-magnetic impulse.

Let $i$ be the intensity of the electric current and $p$ the hydrostratic pressure as measured by the displacement of the level of the mercury. We may calculate $p$ as a function of $i$. To this end, suppose, as is really the case, that the element of the current has the form of a small rectangular parallelopiped, the length of which, taken in the direction of the current, is $l$. The electro-magnetic force which tends to displace the element of the current $= H l i$; H being the intensity of the magnetic field: such is the expression of the force. To find the value of the hydrostatic pressure, $p$, we must divide the expression of the force by the area of the surface upon which it is exerted. This surface is that of one side of the parallelopiped; its dimensions are the length $l$, and the thickness $\varepsilon$, of the parallelopiped taken in the direction of the lines of magnetic force; the area of this surface is therefore $l\varepsilon$. On dividing, we have $p = \frac{H i}{\varepsilon}$

The sensibility of the current increases, therefore, with the magnetic intensity, and with the slenderness of the mercurial column.

Consequently we arm the poles of the magnet with two masses of soft iron which come almost into contact with each other, and which leave between them merely a kind of slit where the magnetic intensity is considerable and uniform. In this interval is a small rectangular chamber of mercury, which forms a part of the horizontal branch of the manometer and which is traversed vertically by the electric current. The thickness, $\varepsilon$, of the sheet of mercury traversed by the current is only $\frac{1}{10}$ millimeter.

The form and the dimensions of this sheet are such that the electro-magnetic pressure is equal in all its points, and that there is consequently produced a state of equilibrium in the mercury without internal vortices.

The apparatus is reversible; that is, if the mercury is set in motion by a mechanical force there arises an electric current in the circuit connecting the poles of the apparatus, which then becomes an electro-motor.—*Comptes Rendus.*

# Electrical Review.

**Published Weekly at 23 Park Row.**

P. O. BOX 3329.

GEO. WORTHINGTON, }
WM. A. HOVEY, } - - - Editors.
THOMAS H. DELANO, - - - - Publisher.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of Delano and Company, Proprietors. P. O. Box 3329, New York.

*We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.*

*We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.*

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NEW YORK, JULY 5, 1884.


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The latest telephonic transmitter reported is said to be as big round as a five-cent nickel, about three times as thick, and costs two cents to make. Those who have seen the "little wonder" say it looks like a button of carbon wrapped in tin foil.

The copper wire now strung between Boston and New York, over which conversation is carried on daily, will be reserved for experimental use exclusively, but it is believed that before many months commercial lines will be in use between several of the large cities of the country.

The latest startling announcement is to the effect that a German physician in Pittsburgh has patented a new device by which electricity is to be produced at one-fourth the present cost, thereby reducing the expense of electric lighting in like proportion. If this be true we would advise the said medical man to give up doctoring and bring his device into practical use. It is the one thing wanted, and when he shows it people will believe it.

The Baltimore and Ohio Telegraph Company has received a large number of letters from prominent newspaper correspondents who attended the Chicago Convention, expressing their thanks for the promptness and accuracy with which their despatches were forwarded. Joe Howard, of the *Herald*, who always does things in a hearty, whole-souled way, writes: "I have sent from four to seven columns daily, and have not had occasion to note one disappointment or break. There has been no bungling and no embarrassment. This, to a correspondent, means much, and to the home office more."

It seems that for the past two years a Blake transmitter has been placed upon the stage of the Academy of Music, in this city, between the footlights and the performers, in order that a bedridden gentleman, Mr. E. B. Fry, might hear something of the music. It is reported that Col. Mapleson received a number of applications from other persons desirous to be similarly accommodated, but that, as the transmitter and case occupied so much room, the Colonel declined. If there is any really serious demand for this sort of thing, the difficulty can very easily be overcome by taking the transmitter out of its case, and disposing of the coil somewhere in the vicinity. We engage that if the service is really wanted, the Metropolitan Telephone and Telegraph Company will prove equal to the emergency.

"They do these things better in France." On a recent occasion in Paris the firemen had occasion to go into the cellar of a burning building, and carried ordinary lanterns in order to see their way. It chanced that, as one of the results of the fire, there had been a break in the gas main, probably because of falling walls, and the accumulation of gas in the cellar was such that an explosion took place as soon as the men entered the cellar, killing and wounding a number of the firemen. Of course there was an investigation, and the investigators, besides inquiring how the accident happened, sought to learn how such accidents could be prevented in the future. The result is that firemen are now provided with electric lamps supplied by portable storage batteries, and when it becomes necessary to enter a building or room in which the presence of gas is suspected, these are used exclusively.

The earliest telephone exchanges appear by the records to have been established in 1877, although it can hardly be said that any of them amounted to much until 1878 was half gone. January 1, 1884, we find 906 in operation, with 4,762 employes and 123,625 subscribers, in the United States alone. Certainly no invention of modern times has come into use with any such astounding rapidity or has come into such universal use. But we are among those who incline to the belief that its use has not more than fairly begun, that it will be applied to many purposes which have as yet been hardly more than thought of, and that it is destined to be improved to such an extent that in ten years from now the instruments now in use will seem as antiquated to the men of that day as do the telegraph instruments of thirty years ago to us. It is true that the instruments now in use answer "well enough," just as the old-fashioned Morse instruments worked "well enough" for those days, and no doubt gave entire satisfaction, but they were clumsy affairs as compared with those in use now.

Rarely has a session of Congress seen so many remonstrances in the shape of memorials against any proposed legislation, as have poured in during the last three months, from every quarter of the land, against the enactment of measures relating to the telegraph that will "increase the number of public officials and create a Government monopoly." These documents come by dozens and hundreds, from town after town, all the way from Eastport to Brownsville and from Key West to Seattle. There must be thousands of them stacked up in the room of the committee to which they have been referred.

Of course it will be said that the telegraph station employes have been set at work everywhere to prepare and circulate these petitions. If so, they have done their work thoroughly. But, after all, the employes in hamlets and even in towns are counted by units, while the signatures to these petitions are in scores and hundreds. They include many well-known names, and their aggregate may be by this time among the tens or hundreds of thousands. Nobody has yet questioned in Congress the good faith or authenticity of any of these masses of petitions against the Government's embarking in the telegraph business.

### *THE UNDERGROUND WIRE BILL.*

In the city of Brooklyn the authorities of the Fire Department applied to the Commissioner of City Works for a permit to extend their fire alarm telegraph lines. In view of the recent enactment of the underground wire Bill, the Commissioner hesitated to grant the permit, and asked the Corporation Counsel, Mr. John A. Taylor, for his opinion. In reply Mr. Taylor says that the meaning of the terms in the act appears to be:

"First—That all telegraph plants hereafter to be established must be placed beneath the surface of the streets.

"Second—That existing plants must also be placed beneath the surface of streets on or before the first day of November, 1885.

"The precise question before me is: Has it been lawful since the 14th of June last for existing companies to place telegraph wires or poles above the surface of the streets? I am well satisfied that so strict a construction of Section 1 of the act, as a negative answer to this question would require, has no warrant in either the letter or spirit of the statute. Certainly an interpretation which would so suddenly paralyze important and necessary means of rapid communication should be compelled by the use of terms plain beyond the field of disputation. I do not find such words. On the contrary, especial recognition of the grave consequences of a too hasty interruption of existing methods, is to be found in the lengthened period given companies to perfect new modes of disposing of their wires, and it is noticeable that this period is placed beyond the entire session of the next legislature.

"Opportunity is thus given to amend or repeal before the time within which the wires are to be removed expires.

"The existing important and complex systems of telegraphy have been established and operated under the sanction of repeated acts of the Legislature for many years.

"Their usefulness cannot be seriously interrupted without greatly affecting the public convenience.

"To give the extreme construction claimed for this section would make it impracticable to repair lines broken by accident or to re-erect poles thrown down from any cause. It would work an instant and oppressive interference with important vested interests, an effect which ought not to be imputed to the Legislature if any other purpose can be spelled out of what they have said. No previous acts are repealed nor is any such prohibition imposed in set terms. It is to be found, if at all, by implication from the words of the first section. These seem to me only declarative of a policy as to future plants.

"If this view be correct, the whole object of the Legislature would seem to be accomplished, if the companies are permitted to so far perfect and repair existing plants as they are disposed to do with a full knowledge that on the first day of November, 1885, they must either have them entirely under the surface of the streets or bear the expense of their being placed there by the proper local authorities.

"I have not overlooked the fact that this special application suggests grounds of public policy (as providing speedy protection against fires) which ought to secure for it the most liberal construction of the act; but in view of the importance attaching to the question as affecting private corporations it seemed proper to consider it solely in that light.

"It may properly be added that a test suit is soon to be brought involving the points discussed above as well as the constitutionality of the act, which will afford a judicial guide to your future action.

"Until that decision is reached I must advise that a permit be issued.

"Very respectfully,

"JOHN A. TAYLOR, Corporation Counsel."

It will thus be seen that Mr. Taylor is of opinion that it was not the intent of the Legislature to put an immediate stop to overhead repair and construction, and that, pending the suit which is to interpret the new law and pass upon its constitutionality, permits should be granted. Doubtless this opinion will have great weight with the Corporation Counsel of the City of New York, who has, as we learn, been asked for his opinion in the case.

The Court of Appeals in London, England, has dissolved the injunction to restrain the telephone company from erecting overhead wires. The Court holds that inasmuch as the space to be occupied by the wires is above the area in ordinary use for street purposes the street authorities have no right to interfere.

### *THE ECONOMY OF ARC LIGHTING.*

So much has been said by interested parties to make it appear that the arc light, as applied to street illumination, is expensive and even extravagant, that it is eminently desirable to get at figures which grow out of actual experience, and learn the lesson which they teach. Fortunately, just such figures are obtainable from the city of Hartford, in Connecticut, where the arc light has now been in use for some time, although on a limited scale up to the present time. It should be premised that the electric light was first introduced into Hartford about a year ago, and that it has stoutly held its own, notwithstanding the violent and almost virulent opposition of the gas company, which has done its best to bring it into disfavor and disrepute, and to oppose its introduction at every possible point. At last its turn seems to have come, for the authorities are loud in its favor, and, in deciding to very materially increase the number of electric lights, report that each light in use actually displaces *six and one-half* street gas-burners, giving, at the same time, at least *ten times as much light*. Now, each street gas lamp costs the city $35 per annum, the lamps burning 326 nights in the year. Six and one-half of these lamps, at $35 per year, cost the city $227.50 per annum. On the other hand, one electric light, which displaces these six and one-half gas lamps, costs the city 65 cents per night for 326 nights, or $211.90 per annum, a saving of $15.60 effected by each electric light per annum. Supposing Hartford to use one hundred arc lamps in its streets—and it is certain that the number in use will be increased to that figure within a very few months—the annual cash saving by displacing 650 gas lamps will be over $1,500, *besides the cost of lighting and extinguishing*, and the light furnished will not only be ten times as great in volume, but of a far better and pleasanter quality.

It will naturally be asked how it is that in Hartford one electric light displaces six and one-half gas-burners, while it was reported not long since that in Boston each arc light replaced but three and one-half gas-burners. The answer is that in Boston many gas lights were kept burning so near the electric lights that their flames actually cast a shadow on the sidewalk, and that, in perhaps a majority of instances, the electric lights were not so placed as to render the greatest possible service. Whatever the cause may have been, it is very certain that certain influences were at work in Boston to throw disfavor on the electric light, and that it was not difficult for those in authority to so "cook" the returns as to make the worse appear the better cause.

But the reports that come from Hartford are those of persons who, at the outset, were bitterly opposed to the electric light, but who now, seeing its numerous advantages, and fully convinced by their own experience of its superior economy, advocate its general introduction for street illumination.

For ourselves, we can say that we have never for a moment doubted the permanent use of the arc light for all purposes, including street lighting, where large spaces are to be illuminated. As we have already said, ten years hence we expect to see ten and perhaps twenty arc lights in use in this and every city where one now burns, and we expect to see such improvements as will render it cheaper, more simple, and far better than it is to-day. We are going to get far more electricity for the same expenditure of power, and far more power for the same expenditure of money. The incandescent light is invaluable in its place, but so, too, is the arc light in *its* place, and it has come to stay.

### *THE DEVELOPMENT OF ELECTRICAL INVENTIONS.*

The growth and progress of electrical invention and discovery may be likened to that of a field of wheat, in which each grain of seed dropped into the ground is doing its own individual work and doing it faithfully and well. Although the result of each such individual effort is small, taken by itself, the result is the harvest, which fills the farmers' granaries and makes him rich. Just so, all over this and other lands, individual men, many of them poor and almost despised, are working out problems for the practical application of electrical force, and although much of their effort is misdirected, although much of it comes to naught, although many go over ground that has been traversed before and has proved barren, still the aggregate result each year is an advance, an improvement, and a sure indication of progress. As things now go there is much waste of effort, and many who, under more favorable circumstances, with a little more encouragement and a little more opportunity to inform themselves of the work of others, would surely succeed, fall by the wayside, disheartened and discouraged, only to see their work taken up and perfected by others, and carried to the point of scientific, practical and pecuniary success. But while we see many who are thus unfortunate, we see many others whose courage never flags, whose enthusiam never wanes, whose faith never falters, and although they may meet with temporary failure over and over again, they are sure to come to the surface after each repulse, determined to win fame and fortune. Such men are called "cranks," but somehow in the end it usually proves that they have a solid idea underlying their seeming vagaries, and it has not infrequently happened that to men of this class the world has been indebted for great inventions. To such men the electrical field is a peculiarly tempting one. There is about it a halo of mystery which attracts them, and its vast possibilities, unknown as yet, lure them on to constant and untiring effort. It is useless to argue with men of this description. Their minds are of the intuitive rather than of the logical sort, and the ordinary processes of reasoning are wholly foreign to them. Had "reason," as it was called, been listened to when the sending of two messages over the same wire at the same time was first proposed, we never should have had either the duplex or the quadruplex. It was denounced as ridiculous and absurd, and as the wild dream of an "enthusiast,"—which is the polite way of pronouncing "cranks;"—but it was worked out to success, and then it was seen that it was based on a train of reasoning so fine that no ordinary mind could, at first, grasp it as such. In fact, instead of being "unreasonable" or "absurd," it was seen that the unreasonableness and absurdity lay wholly in the minds of those who pronounced it impossible.

We confess ourselves optimists and enthusiasts in the matter of the future of electrical invention, discovery, and development, and govern ourselves by Sir Humphrey Davy's rule that, "outside of pure mathematics, it is folly to pronounce the word 'impossible.'" Already the electric fluid gives us light and carries our messages in various ways. To a limited extent we are transforming it into motive power. The time is coming when we shall use it largely and economically for this latter purpose. Again, since it is, like heat, "a mode of motion," we may reasonably expect, at no distant day, to utilize it as heat, both for warming and for culinary purposes. That light, heat, motion and electricity are all correlated, and that one may always be transformed into the other, was long ago proved theoretically and experimentally. The problems now before inventors involve the study of the laws which govern and control such transformations, and the methods which effect them most easily and with the least loss. Exploration has *begun*, and that is about all, in each of these directions. Beyond is a great *terra incognita* which active minds are now bent on exploring. The further they go the larger it looks, and it is not probable that any now living will ever catch sight of its further boundaries. But much must lie within comparatively near reach, and hence our faith that great and important discoveries, especially in the direction of improvements of existing methods and processes, may be looked for in the near future.

In this connection it may be well to call attention to the course pursued by one great interest founded on electrical invention toward investigation and discovery. The Bell Telephone Company, although it has a large, prosperous and growing business based on the use of instruments which would ordinarily be called perfected, maintains at great expense a department devoted to experiment and investigation, whose sole business it is to investigate every alleged improvement or invention connected with telephony, to study constantly to improve the apparatus in use, and to keep an accurate record of all its work. It may be said, of course, that its object is a selfish one, and so it may be, primarily, but it is nevertheless doing its part, and more than its part, towards accumulating exact and reliable information on electrical subjects, and much good has come to the community at large through its persistent efforts in this direction. It would be well if many other electrical companies, with ample means and having important interests at stake, would follow so excellent an example.

### Electric Coast Lights.

By direction of the Lighthouse Board, Gen. J. C. Duane has been since August last experimenting at the Lighthouse supply depot, Tompkinsville, Staten Island, to test the practicability of using electric lights in the Government lighthouse service. He has been aided by Lieut. John Millis, who was especially detailed to make electric experiments.

An iron tower was erected on plans designed by Gen. Duane, similar to the one on Robbin's Reef. It is simply one of the smaller-sized towers common in the service. It was begun in August and finished in November. It is built of cast-iron columns filled in with brick. The height of the focal plane, the center of the light, is fifty feet. The height of the light varies in different lighthouses, according to the distance at which the light is required to be seen. The highest light in the service is that at Stonington, Conn., which is recorded in the official register at 592 feet, intended to be seen thirty miles from the deck of a vessel fifteen feet above the water level.

The experiments have been conducted day and night with the view of determining the consumption of coal, the photometric power of the light, the cost, the effect of the light at various distances, the steadiness, the color, and other details. The report on all these points will be voluminous, and will not be completed for some months. It has been determined that the electric light is ten times more powerful than the most powerful oil light, and that for a given amount of light the electric is the cheaper.

The apparatus used is extensive and costly. First a complete set of apparatus was ordered, such as is now in use in the French service. This consisted of a lamp, a magneto-electric machine, and a "first order" lens constructed especially for the electric light. As the electric light is of a smaller area than an oil light, the lens is smaller and costs less than a lens for an oil lamp. There have also been employed several varieties of dynamo-electric machines, the Gramme, Eliphantstone-Vincent, Siemens, and Weston. There have been some experiments with storage batteries to determine the feasibility of supplying lighthouses with electricity, to be used temporarily in case the machinery breaks down.

The comparison of the relative values of oil and electricity for lighthouses will be a difficult matter. Among the advantages of oil is its cheapness, its availability for use by unskilled persons, and its non-liability to get out of order. Among the disadvantages of oil is the lack of penetrating power. Among the advantages of electricity is the fact that it has greater penetrating power in a fog than oil, but there are disadvantages to be considered in the increased cost of plant, the lack of steadiness, the liability to get out of order, and the necessity for employing skilled labor to manage it. There has been some difficulty in recording the probable cost of permanent lights, as the irregular use of the machinery has increased the cost of fuel. But it is pretty certain that a unit of oil light costs as much as a unit of electric light.

One disadvantage of electric light is its unsteadiness. Thus far there has been no very large electric light used that does not flicker. It has been feared that the flickering might lead to mistaking lights that are stationary for those that are flashing. Further experiments are to be made to determine the power and steadiness of the electric light. Thus far the most satisfactory experiments have been made with the French apparatus, which is the most complete that has been used.

In the remaining experiments the new light is to be observed from the Highlands, Sandy Hook and other points. The extent of the experiments will depend upon the results obtained. The Lighthouse Board has the power to determine whether it would be better to adopt the electric light, and it will be guided in its conclusion by the result of Gen. Duane's experiments. Meanwhile, the value of the electric light as an element in the safety of marine navigation is being rapidly demonstrated by actual use in many directions. The French Government has adopted it extensively, and the English Government to a less extent. A number of steamship companies have used it to advantage, especially in fogs. The Russian Government has adopted it to some extent, and the Brazilian Government also. Even Egypt is ahead of us, as there is an electric lighthouse at Port Said, the entrance to the ship canal.

There are 560 lighthouses under the control of the Lighthouse Board, and the appropriation last year for maintaining them was $2,179,500. There was also appropriated for special purposes $586,850 It appears probable that if the electric system be adopted the appropriation for the lighthouse service must be heavier.

The new electric beacon at Hallet's Point, Astoria, which is to light up Hell Gate, is nearly finished, under the direction of Gen. Duane, and it is to be lighted about the middle of next month. It is a big cluster of electric lights, somewhat like those in Madison Square, only larger. It is not intended to serve the purpose of an ordinary lighthouse, but merely to supply light to guide the pilots in seeing other landmarks. At present the big Sound steamboats are run through Hell Gate only with difficulty and sometimes with danger in the dark. The new beacon is 250 feet high. The lighthouse at the upper end of Blackwell's Island, which now lights Hell Gate, is the property of the city, and is maintained at city cost. This was done because the city authorities were averse to having persons on the Island who would not be under their control.

Some time ago the merits of illuminated paint were advocated for buoys. The Lighthouse Board, however, came to the conclusion that the light could not be strong enough to be seen at any considerable distance, and was therefore of no practical value for buoys. It was thought, concerning the light, that by the time the mariner could distinguish the buoy he would be so near that it would be impossible to avoid running over it. Besides, in cloudy weather the luminosity of the paint could not be restored.

The newly repaired Sandy Hook Lightship will soon resume her old anchorage and relieve the temporary lightship that has been taking her place.

Lieut. Millis has fitted up an electric light over his desk in the office at Tomkinsville station, which is supplied from a storage battery.

### The Electric Ballet.

Cerberus at the gates of Hades is not a more terrible monster than the stage-door keeper of the Empire Theater. He softened, however, when I told him that I had permission from Mr. Hitchins to see the workings of the new electric ballet, so I was allowed to wait until my cicerone arrived. At last M. Levy, who directs the electric ballet, arrived.

"I have come to ask you a few questions about the working of the electric ballet."

"It will be on in ten minutes, come along with me."

M. Armand Levy, it may be said, is the possessor of the patent of these electric jewels in England, having purchased the right from M. Trouve, the ingenious French electrician, to whom we are indebted for this latest and oddest application of electricity.

"The equipment cost £400—that is, the jewels, the reflectors, the batteries—in fact, the installation, if I may use the term, and I dare say it costs £4 or £5 a night to produce the ballet. Every little incandescent lamp cost five shillings; and the acid—ah! sacré," said M. Levy, shrugging his shoulders, "but I must tell you no more. It is enough that I have told you." This is the first time that electricity has been used for theatrical purposes on so large a scale, though one or two nearly as elaborate spectacles have been seen in Paris. "No one can say where it will stop. One invention follows another very quickly. Perhaps we may have something here very shortly which will surpass even this. No—I cannot tell you what it is; we want to surprise you. Why, M. Trouve has just produced at the Follies Bergerer a most lovely ballet, in which the dresses of the girls are literally a coruscation of flowers, each petal sparkling with electricity. What do you think of electric insects? Imagine the air full of dazzling gossamer wings, butterflies, dragonflies—but we shall see. Here is the room where we keep the batteries and charge them. Yes, a little out of order at present, but really nothing to grumble at. Now we have a staff of eight at work to keep the apparatus in working order, fill the batteries, superintend repairs, replace broken lamp glasses; ah! yes, we break a number every night from the pressure."

"Now see," said M Levy, "the light is obtained from this battery; we call it a primary battery. It is fastened behind the shield, which each of the fifty young ladies carries, and this supplies the lights in the spear and the helmet, which make up the equipment. The number of luminous points varies from seven to ten. I call them luminous points, for each performer carries only three electric lamps proper—these being increased, of course, by means of the reflectors."

"No, no. A one-light battery is not at all difficult to manage, but ten—ah!"

I may explain here that each apparatus carries three lamps proper—one on the shield, another in the spear, a third in the helmet. In each case the lamp is placed in a small space enclosed by "jewels"—diamonds and rubies—four set in the form of a square and one on the top. Surrounding the jewels composing the pentagon is a square wire spray, at each end of which, corresponding to the four jewels, is a mirror. Just then some of the fifty young ladies who take part in the ballet began to troop down stairs from their dressing rooms, and came up to the bench on which were laid out ready for adjustment the fifty oblong batteries, each in size about seven inches long, two inches wide, and some four inches deep; the total weight when charged being three pounds.

Each of the batteries, it may be said in conclusion, is charged in the day, and laid ready for use about half-past ten. Each would, according to M. Levy's calculation, contain a supply for an hour; as a matter of fact, they are only needed for about a quarter of that time. Of course there are lighter batteries and batteries of other shapes than the oblong one which is now in use. At present the Amazons do nothing more than march through a series of evolutions. But with lighter ones, perhaps yielding a less brilliant effect, they could pirouette as gracefully as ever.

The business of the telegraphic office in Augusta, since Mr. Blaine's nomination, has been immense. For the week ending June 10, 53,932 words were dispatched over the wires.

## Telephonic News

⁂ The Cumberland Telephone Company declared a quarterly dividend of 2 per cent. payable July 1st.

⁂ On another page will be found an advertisement of a two-thirds' interest in a Mexican telephone company for sale, the owner wishing to go abroad.

⁂ The Nashville, Tenn., Telephone Exchange has now 975 subscribers. This exchange has shown a remarkable growth since the Cumberland people took hold of it.

⁂ The Telephone Exchange at Evansville, Ind., owned by the Cumberland Telephone Company, has 600 subscribers, all taken care of by three operators, and the service is said to be excellent.

⁂ The application of the Bell-Blake telephone apparatus on the St. Petersburg and Moscow line has proved most successful. Some very interesting experiments have been made, and, notwithstanding a distance of 300 versts, the communications interchanged were perfectly clear.

⁂ Mr. Samuel M. Cartright, late superintendent of the Eastern Division, has been appointed general solicitor of the Pennsylvania Telephone Company. The territory comprises the counties of Adams, Berks, Cumberland, Carbon, Dauphin, Franklin, Fulton, Lancaster, Lebanon, Lehigh, Monroe, Perry, Northampton, Schuylkill, and York, in Pennsylvania; and Warren and Hunterdon in New Jersey. Mr. Cartright's headquarters will be in Allentown, Pa.

⁂ An interesting table of German telephone statistics has appeared, showing what has been done in the German Empire by the post-office, in whose hands is vested the sole control of the telephone. At the end of 1883, there were 5,851 telephones connected —or 6,182 if we include those fixed in telegraph stations for the telephonic dispatch of messages received there—or, in all, only about as many in the whole of the Fatherland as there are in the two cities of New York and Boston.

⁂ Gen. Edward H. Ripley and George T. Chaffee of Rutland, and Dr. C. W. Brigham of Pittsfield, met in Pittsfield, Mass., on Saturday last, to arrange for the extension of their lines running between Bethel, Rochester, Stockbridge, and Pittsfield to Rutland via Sherburne, passing the residence of the Hon. Dan. W. Taylor, with an office at the well known and popular hotel of Ben Maxham. It will run to the Pico Mills of Chaffee & Son, with a branch thence to Killington. From Chaffee's mill it will run to Rutland via Mendon. The line from Woodstock to Bridgewater will probably be extended to connect with the new line at Ben Maxham's, thus putting Rutland in telephone communication with all the towns on the east side of the mountain to the Connecticut River. The line will be built at once.

⁂ The paid up capital of the Bell Telephone Company of Canada is one million dollars; assets, about one million two hundred thousand dollars. The company is paying seven per cent. dividend to its shareholders.

| | |
|---|---|
| The net revenue for 1882 was | $69,590.15 |
| " " " 1883 " | 112,233.50 |
| Showing an increase | $42,643 35 |

The Bell Telephone Company of Canada offers for sale $100,000 six per cent., ten year first mortgage bonds at 93 and accrued interest from 1st April, 1884, which price will pay the purchaser seven per cent. per annum interest, payable half-yearly on 1st October and 1st April. These bonds are in denominations of $1,000, $500, $250, and $100, and form part of an issue authorized by act of Parliament, which is a first lien upon all the lines, works, and plant of the company.

⁂ Superintendent Walling, this city, notified the police captains Saturday that under the new law "all telegraph, telephone, and electric light wires" in this city "must hereafter be placed under the surface of the streets, lanes and avenues." He bade the captains enforce the law, adding:

"This is not intended to prevent keeping in repair any wire or cable now in use, but is intended to prevent putting up lines or wires above ground."

Mr. Walling says that since the passage of the law the companies have erected large numbers of poles all over the city, and that, while the police cannot prevent that, they can and will prevent them from being strung with wires.

⁂ The Boston *Herald* says that a new telephone company has just been organized, called the Republic Telephone, Telegraph, and Manufacturing Company. Three concessions, including the use of telephone and district telegraph, beside a special pole concession from the City Council of the city of Mexico, giving the privilege to erect poles throughout the federal district, have been granted to Saturnino Islas, G. L. Wiley, and others, for the company, and applications have been made for various electrical patents. Mr. Islas is the most prominent electrician in Mexico, and has made some valuable inventions, including a long-distance transmitter, which the company will use. Mr. Wiley was formerly general manager of the Mexican Telephone Company. The new company is identical in interests with the Mexican National Telephone Company, recently organized in New York.

⁂ Toward the end of last year an enterprise had been completed in Upper Silesia which promises to confer great benefits on the inhabitants; it is the general telephone exchange in the Silesian mining district. Already in June, 1882, the establishment of a telephone exchange was projected at Benthuen, whence lines were to radiate to Tarnowitz, Myslowitz, Königshutte, Kattowitz, and Gleiwitz, connecting the different works, pits, and mines. The Silesian Mining Association decided upon contributing £1,500 towards the cost of the installation, which was estimated at £4,000. This enabled the German Post Office to fix the subscription at the moderate amount of £10 per annum. On December 11, 1883, the exchange was opened, 73 instruments being in use. The area covered by the telephone is 1,660 square kilometers, with 807 kilometers of wire. The greatest distance between two telephone installations is 60 kilometers. From the 11th to the 31st December, 5,159 connections were made, which works out to 322 per day. At present 39 new subscribers are being connected, the length of line required being 373 kilometers.

### The Edinburgh Chamber of Commerce and the Telephone.

The Edinburgh Chamber of Commerce and manufacturers have addressed a memorial on the question of telephone facilities to the Postmaster-General, of which the following is the text:

"That your memorialists, in common with the whole mercantile community, are deeply interested in the telegraphic communications of the country, and in securing for the public the full benefit of all new electric inventions. That your memorialists are fully sensible of the immense benefits secured to the public by the purchase by Government of the telegraph system of the country, and the admirable manner in which the post-office authorities have developed the system; and they also heartily acknowledge the readiness with which the Postmaster-General has granted increased facilities for communication by telegraph and otherwise. That the telephonic system, having now established itself as a most valuable means of communication, your memorialists are of opinion that Her Majesty's Government should grant such facilities as will encourage and develop this important system, without unduly interfering with the revenue of the department. Your memorialists therefore urge that Her Majesty's Government may, in the same spirit in which they have developed the telegraphic service of the country, grant such facilities as will also encourage more widely the adoption of the telephone system."

The memorial is another sign of the great interest awakened in the business community by the late discussion on the telephone question in Parliament, and we trust that it will contribute to inducing the Postmaster-General to grant the facilities so urgently needed for the development of the telephone throughout the country.

### Light Sub-Marine Cables.

There is no characteristic of a sub-marine cable which exercises a greater influence upon the question of laying and picking it up, than its weight. Not only does the cost of a cable increase with its weight, but so also does the size of the ship required for its transport and the strength of the machinery by which it is paid out. And when from any accident the cable has to be recovered, the element of weight attains a double importance, particularly if the operation has to be conducted in deep water. The case sometimes presents itself when the breaking strain of the cable is less than the weight in water of the portion which must be lifted to bring the cable to the surface. It is then necessary to effect the raising by means of two vessels, and this evidently increases the length and difficulties of the operation, and consequently also the cost.

Hitherto a considerable weight has been given to the cables on account of the copper conductor, which cannot play any useful part in the work of supporting the strains to which the cable is subject. The copper has, in fact, a very low breaking strain, and is easily extensible, so that if it be subjected in any way to the strain to which the cable has to be submitted, it will immediately stretch beyond the limit of its elasticity, and will take a permanent set, while the substances by which it is surrounded will return to their initial length. It therefore results that, being no longer able to accommodate itself in a case too short for it, the copper wire takes a sinuous form, and sets up at certain points distortions which have the effect of moving the wire from the center of its insulating envelope, and finally of opening a way for the escape of the current. This accident is easily produced artificially for the purposes of demonstration.

The employment of a conductor with a conductivity equal to that of copper, and a mechanical resistance notably superior, would have the immediate effect of relieving the sheathing of a part of the strain which it has to resist, and, consequently, of permitting of a reduction in its dimensions and weight.

M. Lazare Weiller is now manufacturing wires of silicious bronze which attain a conductivity equal to from 97 to 99 per cent. of the standard, that is, with a diameter of one millimeter, and at a temperature of zero (C.), they have an electrical resistance of 20.57 ohms per kilometer. These wires have at the same time considerable strength. They break under a strain of 45 to 48 kilos. per square millimeter (28.57 to 30.48 tons per square inch), and with an extension at the moment of rupture not exceeding 1 to 1½ per cent. They have thus the high conductivity of copper, and the mechanical strength of the best iron. By reason of these valuable qualities they encourage an anticipation of the possibility of manufacturing light submarine cables, a result long sought for without success. They allow a part of the strength furnished by the wire covering to be reduced, and consequently the weight of the covering itself to be lessened. It is, however, necessary that the sheathing should be retained to protect the wire and its insulating envelope against accidents which may befall it, and more particularly against the attacks of marine animals. It is not to be hoped that this covering can be entirely dispensed with, but it will be a great advance if it be possible to effect a reduction in it.

As example of the economy which could be realized by the core being made to aid in giving strength to the cable, we may cite the case of the Compagnie Francaise de Paris a New York, called the Pouyer Quertier cable, constructed and laid by Messrs. Siemens Brothers, of London, in 1879. The deep-sea section is constituted per knot of 1949 yards as follows:

| | lb. |
|---|---|
| Copper conductor | 485 |
| Gutta-percha | 396 |
| Hemp | 176 |
| 18 wires of galvanized iron, 2 mm. in diameter | 1895 |
| Exterior hemp and composition | 881 |
| Total | 3833 |

The total diameter was 1.18 in., and the strength 6613 lb., including the wire covering. Under water, the cable only weighed 992 lb.; it could consequently support six miles of its length under water.

An examination of the chart of the Atlantic shows that there is a sort of a longitudinal tableland in which the depth varies from 1.8 to 2.4 miles. From one part to the other the depths descend to 3 7 miles, and in various depressions, of which the principal are to the west of the Canaries, to the south of Newfoundland, to the north of Port Rico, and between St. Helena and Rio, they exceed that depth. In the Pacific all the space included between North America and Japan is occupied by the Tuscarora depression, of which the depth varies between 3.7 and 4.9 miles, while parallel to Japan there extends a depression in which has been found the greatest depth of 5.3 miles. If then it be considered that in raising the cable, the ship has to sustain with the grapnel two lengths of cable against the vertical component of their weight, it will be seen that at many parts of the ocean, an ordinary cable would be broken by its own weight in the act of lifting.

Taking advantage of the properties of silicious bronze, M. J., Richard, manager of the Societe General des Telephones of Paris, and formerly chief engineer of the Telegraph Service, has constructed a new type of light cable, which the reputation of its author, who has a long experience of submarine telegraphy, should recommend to the attention of engineers interested in this question. The core consists of a silicious bronze wire of a weight equal to that of the Pouyer Quertier cable, 485 lb. to the knot; the gutta percha envelope has also the same weight, 396 lb., also the hemp covering, 176 lb., while as for sheathing, it consists of 28 wires of galvanized wire of 1.25 mm. diameter, covered with hemp strands. The weight of the wire is 1100 lb., and the weight of the exterior hemp 551 lb. The total weight of the cable thus constituted is 2711 lb. in air and 665 lb. in water. The diameter is .98 in., and the breaking strain 6172 lb., of which the core bears quite half. Under these conditions it can support in the water seven or eight knots of its length without breaking.

It is thus seen that in this cable, with a conductivity equal to that of the existing cabls, and a strength almost the same, there is a volume and weight equal respectively to two-thirds those of the weight of the cable selected for comparison. It would cost about £32. per knot less, and as it could be laid with smaller ships and machinery, would be cheaper in that respect.

This would be the type of deep-sea cable, suitable for the parts where the water is at rest, and where animal life is rare. At the shore ends it would be necessary to employ sheathing increasing as the depth decreased. The design of which we have spoken is the first which has been actually produced. It is probable that subsequent experience and consideration will lead to important modification, but meantime the experiment is worthy of careful consideration, for it diminishes the initial expense and the expense of laying, at the same time preserving the necessary qualities, and permitting of its being picked up from greater depths.

⁂ The latest returns of the Bell Company for the month ending June 20, show that the output was 4568, as against 7038 for the corresponding period last year.

### Vincenti's Modification of the Bobbins of Electro Magnets.

The ordinary bobbins are replaced by a thin sheet of copper, whose width is equal to the length of the arms of the magnet, and the successive layers of sheet copper are insulated with gum lac and silk ribbon. A maximum magnetic effect is obtained when the number of revolutions is such that the resistance of the band is to the external resistance as the thickness of the uncovered band is to that of the insulated one.

In order to obtain the results, Müller's rule must be conformed to, that is to say, the diameter of the core must be equal to the thickness of the magnetizing bobbin (in which case the resistance of the latter will be equal to twice the external resistance), and the length of each arm of the magnet must be six times greater than its diameter.

### Some Leading Exhibits.

Some of the exhibits for which space has already been asked, give assurance that visitors to the Electrical Exhibition will have an opportunity of gratifying not only the desire for information in special lines of electrical studies, but will have presented what may be styled electricity practically applied in every variety of form, from the most delicate instruments of measurement to the every-day contrivance for small motors, not forgetting for entertainment of young people, mechanical toys, conjurers' tricks and other "popular displays."

At this early date the number of applications is large, and covers a majority of the subjects enumerated in the classification. The prominent electric light companies—Edison, United States, Brush, Thomson-Houston, Van De Poele, McTighe, Acme, Ball, Imperial and others—will not merely exhibit their dynamos and lights, but will arrange accessories, so as to show the character of the lights from their lamps upon furnished rooms, pictures, machinery for weaving and spinning and the general effect in actual use.

The electro-plating companies from the United States and Europe who have applied for space will exhibit their machinery in practical operation. There will be in this line interesting displays of bas-reliefs and artistic work from the United States Art Metal Co., of New York.

The display of fine instruments and apparatus of special interest to science and education already promised is quite large. Prominent among these exhibitors is the Telemeter Co., with their electrical apparatus for telegraphing the reading of thermometers, barometers and steam gauges at a long distance. Vejtruba, of Prague, with his microphone, agioscope, pinakoscope, electric clocks, etc., and the Signal Office and departments will present, among their large displays, Eccard's self-register for anemometers, the portable field telegraph and telephone in connection with Siemens' cable, and numerous other electrical devices.

Hilbourn L. Roosevelt, the prominent organ-builder of New York, will give, for the benefit of ladies and musical people, "music in the air," having applied for space for his vocalion and organ—the former to be suspended from the arched roof, and the latter placed in one of the grand galleries, both to be operated by key-boards from the floor.

There are many interesting electrical devices that are in daily use, and familiar to persons in the business, that are unknown instruments to the outside world. Special displays of these have been arranged to be shown in active operation. The Bell Telephone Co. will have their system of exchange at work, with young ladies performing their duties, as in the large offices of the company.

There will be a great variety of telegraph systems and instruments. Among these, of course, will be duplex, quadruplex, and, especially, the synchronous multiplex.

The space asked for by the New York Electrical Supply Co., Jas. W. Queen & Co., of Philadelphia, and others from America and England, insures an exhibition in philosophical instruments that will attract general attention.

It is, of course, impossible, to give in a brief newspaper column a satisfactory notion of the large variety of attractions prepared for the public. We have only referred to our lists as indicative of what is being done, and will hereafter in each number of the *Bulletin* give more or less incidental reference to the progress of our work.

Applications are coming in daily, but, owing to the courtesies and facilities extended by the Pennsylvania Railroad Company in affording space, there will be reasonable room for all applications.—*Bulletin of the International Exhibition.*

### Technical Education in Europe.

A second and important installment of the Royal Commission, appointed in 1881 to inquire into the subject of technical education, was published on May 16. The preliminary report presented during the session of 1882 dealt exclusively with the condition of things in France, where educational development has been most remarkable. The percentage of illiterate conscripts in 1833 was forty-seven and eight-tenths; in 1867 it had fallen to twenty-three, and in 1880 to fifteen per cent. The law of the 16th of June, 1881, which came into operation on the 1st of January following, decreed gratuitous instruction available for the working classes throughout an extended series of schools, commencing with the Salles d'asile, which are being converted into kindergarten schools, and graded upwards to the "superior elementary schools," in which technical instruction is given, and trades taught. The commissioners appear to have been favorably impressed with what they saw of the handicraft teaching of the Christian Brothers in France, Belgium and Ireland. The combination of manual with ordinary literary instruction imparted to very young children appears to have been first tried in 1873, at the communal school in the Rue Tournefort, with such satisfactory results that schools of the same type are being rapidly and extensively established. "Drawing, modeling and carving are taught as part of the curriculum; and lathes, forges and joiners' benches are as much matters of course as desks and blackboards. In the Boulevard de la Villette is the apprenticeship school, established some twelve years ago by the City of Paris, for boys who have completed the ordinary primary school course, and to whom is given what professes to be a very thorough training in the theory and practice of numerous handicrafts, the pupils especially distinguishing themselves as pattern-makers and engine-fitters. Nearly fifty thousand pounds is said to have been expended on the establishment of this institution, and nearly three thousand pounds is required for its annual maintenance." The abolishing of the old system of apprenticeship is the main object of this institution. The most striking examples of primary schools are to be found in the Swiss cantons. In Zurich a communal school is described, the building of which cost sixty-six pounds per pupil—five times the much-complained of London average. There are no fees, and ninety-seven and a half per cent. of all the children of school age are said to attend schools of this type. The average attendance is returned as 95—a remarkable contrast to the 72 per cent. which was the average in England and Wales a year ago; and no proposal for the reduction of school expenditure can find a hearing as an election cry in Switzerland. Without a mine, a canal or a navigable river, Switzerland carries on extensive cotton and silk weaving, paper-making and calico-printing works; and the report grows quite enthusiastic on the aniline-color works of Basle, an abundant supply of skilful chemists being thoroughly trained in such institutions as the Polytechnicum at Zurich, or the Bernoullianum at Basle. The report shows that the higher educational institutions are as various in the different countries as they are generous and complete in most. In the German empire there are twenty-four universities. The buildings for the Strasburg University are now nearly complete, and are to cost six hundred thousand pounds. The department of botany has had a sum of twenty thousand pounds devoted to it: that of physics, thirty thousand pounds; and that of chemistry, thirty-five thousand pounds. The votes for maintenance are similarly ample. The rivalry between the universities and the polytechnic schools is wholesome, if costly. New buildings are now being completed at Charlottenberg, in which the work of the old technical HighSchool of Berlin will be carried. There are many intermediate schools between the primary schools and the universities and polytechnic schools. The "Fortbildungsschulen" of Germany are very beneficial institutions. "The work of the primary day schools is carried on in evening classes with direct and practical bearing on the occupations upon which the pupils have entered. But in every country, and notably in France and Belgium, there are night classes provided for the instruction of the industrial classes in drawing and modeling, directly applied to decorative art, as well as in popular science and general knowledge. Then, again, there are schools still more specialized for instruction in weaving, in practical mining, in dyeing, and in designing for every conceivable kind of artistic manufacture. This teaching is often gratuitous; but, where fees are exacted, they are always small; and there is everywhere prevailing a system of bourses and scholarships by which meritorious pupils are enabled to carry on their studies. The State, the province and the commune bear the charges in their alloted proportions." The use of museums and art galleries, open on Sundays for the benefit of designers, is much dwelt on by the commissioners, who embody a recommendation of Sunday opening in their report.

Mr. Samuelson and his colleagues traveled at their own expense, and have spared no exertion to place their facts before the public in a complete and useful manner.—*Ex.*

The report of the Postmaster-General of Costa Rica for the year ending 31st March, 1883, discloses all the difficulties under which the Post Office is laboring in that Republic. The Postmaster-General has only recently been appointed, and takes the greatest pains to develop that institution. The country has joined the Universal Postal Union since 1st January, 1883. The number of letters and parcels shows a considerable increase against former years, and was 1,172,219 during the year 1882–83, of which 259,729 were ordinary letters, and 42,890 letters carried free of charge. It seems that almost all the officials of the Republic enjoy unlimited Post Office franks. The Postmaster-General has proposed to the Government to limit this facility to the superior officials. Post cards have lately been introduced, and are largely increasing. The postal communication between Punta Arenas on the Pacific and Puerto Limon on the Atlantic has been much improved of late.

In regard to the frequent troubles experienced by Mexican telegraph and telephone companies, it has been suggested that some energetic measures should be taken to prevent the interruption of telegraph communication by the cutting and stealing of the wire which have proven effective in breaking up the custom of train wrecking. It is important that communication with the world at large should be maintained uninterruptedly, and the Cable Company has gone to a considerable additional expense to provide improved facilities to the public, keeping the office open day and night. But, although we have repeatedly called attention to the abuse, no steps have yet been taken by the authorities to stop it, and scarcely a day passes when several hundred meters of wire are not stolen. And even when the rascals are caught, the indifferent judges before whom they are brought view it as an offence so trivial that they discharge them with little or no punishment, measuring the crime simply by the value of the wire stolen instead of by the loss to the company and the public through the interruption of communication. When judges do not know how to administer the law any better than that, it is time they were replaced by men with more enlightened ideas on the subject of proprietary rights and the gravity of offences against them. Let it not be said that Mexican justice makes of thievery a privileged calling!

## TELEGRAPHIC

.... The Direct Spanish Telegraph Company's duplicate cable between Kennack Cove, Cornwall, and Bilboa, Spain, has been successfully laid, and is in perfect working order.

.... In our issue of the 14th instant we stated that the Central and South American Telephone Company had just held its annual meeting. We should have said the Central and South American Telegraph Company.

.... The telegraph line on the Ontario and Quebec Railway was finished on the 7th inst. The work was only commenced on April 1st, so that the whole 200 miles has only taken two months in construction.

.... J. Miller Kelly, president of the Board of Aldermen, has been indicted, under the new code, for agreeing to accept a bribe of $2,500 from the Baltimore and Ohio Telegraph Company to permit its lines to run into Rochester. A bench warrant has been issued, and bail has been fixed at $10,000.

.... The Bankers and Merchants' Telegraph Company have completed two wires to Newport, and the branch office at the Aquidneck House is in active operation. The main office in the Daily News Building will be ready for business in a few days with two more wires. This is the first opposition company to reach New York.

.... The concession granting the right to lay a cable between Portugal and America, which was obtained some time ago, has been transferred to a London joint stock enterprise entitled the American and British Continental Cable Company. The first section of the cable to St. Michael's, one of the Azore Islands, will be laid in September.

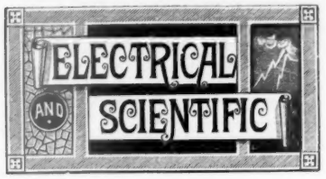
.... The Western Union Telegraph Co, through its leased line, the Mutual Union, has reduced its rates between this city and Chicago to twenty cents for ten words, and to St. Louis to forty cents. It is understood that the reductions are made to meet the uniform rate of forty cents of the Baltimore and Ohio to both cities, and that the greater reduction to Chicago is made because the Baltimore and Ohio has greater facilities to that city.

.... The annual meeting of the Philadelphia, Reading and Pottsville Telegraph Company was held Tuesday morning at the office of the company in this city. G. A. Nicolls was chairman and Howard Hancock secretary. Following officers were elected: President, George DeB. Keim; directors, J. B. Lippincott, Henry Lewis, E. C. Knight, G. A. Nicolls; secretary, Howard Hancock; treasurer, John Welsh.

.... Mr. Gisborne, superintendent of the Canadian Government telegraph service, has been for some time engaged in the preparation of a map showing the railways and railway stations, telegraph lines and telegraph stations, canals, trails, etc. The third sheet is now out. It includes the west central section of Canada from Lake Superior to the Selkirk range of mountains in British Columbia, and is a particularly fine map. The fourth and last sheet of the series is now in press.

.... Superintendent Walling sent out an order last Friday directing the police not to interfere with the erection of poles and telegraph wires by the Baltimore and Ohio Company. The counsel of the company on Saturday told the Police Commissioners that it would be unjust, when the line from Boston to New York was completed all but a few miles, to prevent the company from finishing that part which was within the city limits. He also argued that the new law providing for the laying of wires under ground after Nov. 1, 1885, did not prohibit their being strung on poles now.

The Commissioners came to the conclusion that the law was inoperative now, and would not be of much practical effect after Nov. 1, next year, as no penalty is provided for failure to comply with its provisions.




* * The Italian government has determined to offer, on the occasion of the opening of the Turin Exhibition, a prize of 10,000 francs for the most practical process for the transmission of electricity.

* * In an improved bichromate of potash battery, M. Luig Ponci uses a liquid of this composition: One kilogramme of bichromate, crushed and dissolved in four liters of boiling water, to which two liters of chlorohydric acid are added. No formation of crystals takes place in the battery with this solution.

* * The net profits of the Suez Canal for the past year were a little over $7,000,000—profits which exceed by far even the most sanguine hopes of some of the original shareholders. An experiment is now being made along the canal for lighting it by electricity, and it is expected that mail steamers will shortly be able to pass through the canal by night. Hitherto night traffic in the canal has been entirely suspended. It would seem from the forgoing that the Panama Canal might possibly be an equally great success.

* * The grand prize of mathematical sciences is offered this year by the French *Academie des Sciences* for the most successful memoir on the following question: "To perfect in every important point the theory of the application of electricity to the transmission of energy." The prize will consist of a medal of the value of 3,000 francs. The memoirs must be remitted to the secretariate before 1st of June, 1884; they must bear an epigraph or device, repeated in a sealed envelope containing the name and address of the author. This will not be opened unless the memoir to which it belongs is successful.

* * Dr. Aron, we are informed by *Engineering*, exhibited at a recent meeting of the Electro-Chemical Society, of Berlin, specimens of vegetable carbon made conductive and incombustible by being strongly heated either in vacuo or in a neutral atmosphere. This artificial graphite does not assume the crystalline structure of the natural mineral. We have long known that graphite could be formed by the influence of high temperature under especial conditions. It is now shown by Dr. Aron that by the same influence soot can be rendered as good a conductor as graphite.

* * Dr. Gore has investigated the degree of force required in an electric current in order to hinder a chemical combination. To show that the chemical and electric forces can be balanced, he takes a solution of silver and of cyanide of potassium, and plunges into it two electrodes, one of silver the other of platinum. The silver electrode tends to dissolve, with an energy which depends upon the richness of the cyanide and its temperature. This tendency is counteracted by passing a current through the electrode, the intensity of which is measured by the ordinary methods. When the current arrests all chemical reaction, the two forces are in equilibrium. This method, simple as it is and susceptible of a great variety of applications, is very fruitful in results, and opens to science a new field for the measurement of chemical forces.

* * After a series of tests covering many months, the American Torpedo Works will send one of their electric torpedo boats to the Horse Shoe, at Sandy Hook, for trial at the United States Experiment Station. The boat is a long, cylindrical, iron vessel, which is submerged till nearly under water, and run by electricity from the shore. This is done by means of copper wires. This torpedo boat can be used as safely and as readily at night as in the day time, and it never fails to stick the torpedo to any vessel toward which it may be directed. Night tests have recently been made with it, and its work has been all that is claimed. It is swift, noiseless and silent, and undoubtedly one of the most horrible engines of warfare that has ever been invented. It is understood that the Government officials who have witnessed its workings are much pleased with its perfect action.

* * The growth of manufactures of the United States since 1850 is thus given by Mulhall's Dictionary of Statistics: Value of American manufactures in 1850, $1,060,000,000; in 1860, $1,970,000,000; in 1870, $4,230,000,000; in 1880, $5,560,000,000. In 1860 the value of manufactures per inhabitant was $61.75; in 1880, $110. In 1850 the number of persons employed in manufactures of all kinds was 957,000; in 1860, 1,311,000; in 1870, 2,054,000; in 1880, 2,739,000. In 1850 the wages paid were $245,000,000; in 1860, $400,000,000; in 1870, $805,000,000; in 1880, $990,000,000. In 1850 the capital invested in manufactures was $550,000,000; in 1860, $1,040,000,000; in 1870, $2,205,000,000; in 1880, $2,405,000,000. These statistics are taken from the census reports, and are approximately correct.

* * The electrical transmission of energy has been working regularly and very successfully for some months past in a coal mine near Vienna. The two dynamos employed are Gramme machines; the generator gives a current of fifteen amperes, with an electromotive force of 500 volts. The receiver produces about eight horse-power, at a distance of 1,900 meters, and actuates through friction wheels a pump, which delivers 300 liters of water per minute, at a height of sixty meters, and through a conduit 800 meters long. Before the adoption of the electrical machines a steam engine was used, the radiating heat from which rendered it very uncomfortable to remain in the gallery. The employment of dynamos has caused the temperature to fall about fourteen degrees. It is also said that the consumption of fuel is considerably reduced.

* * A European journal relates that a few months since workmen employed upon some constructions on the bank of the river Dnieper, in Central Russia, employed the electric light to enable them to prosecute their labors at night. The brilliant rays of light attracted so many millions of nocturnal moths, beetles, and other insects, that from time to time it was necessary to stop work and set all hands to destroying the clouds of winged victims that frequently obscured the light. This suggested the idea of employing the electric light to destroy nocturnal insects prejudicial to agriculture, and experiments in that direction are to be tried. Not only to insects, but to fish, the light proved fatally attractive. Its rays, directed to the surface of the water, drew together vast quantities of all the fishes found in the Dnieper, and when within the charmed field of illumination they lay crowded together in masses, seemingly blinded and stupefied, the workmen, improving the opportunity, made a notable haul of fish.

* * On the electric railroad lately opened by Lord Spencer, with a large number of eminent scientists, between Portrush and Bushmills, Ireland, the electricity, generated at a waterfall on the river Bush, and conveyed to the end of the line by an underground cable, is carried along through a conducting rail, which is supported on insulators at some distance above the ground. An arm, with a brush or pad on the end of it, stretches out from the train and keeps contact with this conductor. But on the day when the Lord Lieutenant came to "inaugurate" the line, it was suddenly found that there was a serious hitch. The engine declined to draw the car. The machinery was in perfect order; the connection with the conductor was all right, and yet there was no motion. Horror filled the souls of the public-spirited promotors of the first electric line in the United Kingdom. It was discovered, happily before much time had been lost, that somebody had rendered progress impossible by the simple expedient of driving a piece of iron from the electric rail into the bank at the side, so that the current was being absorbed by the earth as fast as it was transmitted from the brush. The iron being removed the vice-regal party made a successful trip.

* * M. Lartigue, the well-known French engineer, has applied electricity to the traction of the panniers or cars of his single rail tramway. This tramway is, as we stated some time since, employed in Algeria for transporting esparto grass from the interior by the traction of camels. It was an easy step from animal to electric traction, and M. Lartigue had successfully taken it. At the recent Agricultural Exhibition in the Palais de l'Industrie, of Paris, an experimental line was shown on which five iron panniers, or double cars in the form of seats, were drawn by a dynamo-electric locomotive at the rate of seven miles an hour. The total weight of the five cars and the electric locomotive was about a ton, and the maximum power required was three horse-power. The dynamo of the locomotive was a Siemens $D_s$, and the generator, which stood about 100 yards from the line, waa a Siemens $D_2$ dynamo capable of developing from 5 to 6 electric horse-power. It was driven by a Herman-Lachapelle steam engine. The total length of the line was 123 meters. It was built of forty-one rails, each three meters long, and comprised curves of seven and one-half meters radius. The locomotive dynamo was carried by a platform car or pannier, and geared with a grooved driving wheel thirty centimeters in diameter, which ran upon the rail. A rheostat to graduate the speed, switches to stop, start, and reverse the motor, and a seat for the conductor, were also carried by the locomotive car. The train was properly coupled to the locomotive, and ran on small grooved wheels. The current was brought to the dynamo by two insulated conductors, one connected to the rail, the other to the dynamo through small contact rollers in connection with the commutator. One switch was employed to start or stop the train by making or breaking the circuit; the other to reverse its motion by reversing the current. The rheostat, by interpolating resistance into the circuit, allows the strength of the current to be varied and the speed of the train to be increased or diminished, as the case may be. The work was carried out by Messrs. Siemens, and under the direction of M. G. Boistel. The economy of the working is, of course, largely dependent on local circumstances.—*Engineering.*

### A New Motor.

The Pneumatic Tramway Engine Company of New York has recently issued a prospectus, in which it presents the claims of compressed air as a motor for short lines, with statements of the results of experiments with a motor built for them by the Baldwin Locomotive Works. The engine was used experimentally, on the Second Avenue elevated Railroad in New York City, with what would seem to have been very satisfactory results.

The locomotive has four driving-wheels, two working cylinders of twelve inches and a-half diameter and eighteen inches stroke of piston, with running-gear like that of the standard steam locomotive of small power. In place of the boiler there are four air-reservoirs, each three feet in diameter, of Otis steel, half-an inch thick, having a tenacity of seventy-five thousand pounds per square inch of section, and made up with the spiral seam introduced by Root. These reservoirs are tested to eight hundred pounds per square inch, and are filled with air at six hundred pounds. A small steam boiler inside the cab is used as an air-heater, and raises the temperature of the air leaving the reservoirs, and on its way to the cylinders, to about 240° F. A reducing-valve causes the pressure to fall, at the cylinders, to a hundred pounds per square inch, the working pressure for the engine. The cylinders are lubricated in part by the water taken up in the heater, where the air bubbles up through the confined liquid, and in part by oil, introduced for that purpose. The main valve is worked in full gear, and expansion is obtained by the use of an independent "cut-off valve" on its back.

The "braking system" is as novel as it is ingenious and effective. The engines are reversed, as in the method of Le Chatellier; and they thus become pumps, taking in air, which is forced into the main reservoirs to replace that expended in propulsion. The system is made still more effective by taking this air, not from the exhaust-pipe, but from the air-brake cylinders beneath the cars, and thus operating the continuous brakes on each car as well as the same work is done by the common Westinghouse system.

The experimental engine has drawn trains of three and four loaded cars from Harlem to the Battery, New York City, a distance of nine miles, in two minutes and a-half less than schedule time—forty minutes—making all stops, and on three-fourths of a single charge of air. The engine will handle well alone, with a pressure of twenty-five pounds.

It is impracticable to cover long distances without refilling the reservoirs, and it is not proposed to attempt doing so. The reservoirs are to be filled at every ten-miles run, or every forty or fifty minutes; and filling stations are to be provided at proper intervals along the line of the road. The reservoirs are so well made that the engine stands all night, under a pressure of one hundred pounds, without appreciable loss of pressure.

The obvious and unquestionable advantages of this method of transportation are: safety from the dangers of explosion, which, aside from simple pressure, are unavoidable with steam and water; perfect cleanliness, not only on the engine, but along the line and on the train, in consequence of the avoidance of dust and smoke, and sparks from the engine; freedom from gas from the locomotive; less noise than with the steam engine; freedom from the annoyances from dripping hot water, soiling the clothing and half scalding the unfortunate pedestrian beneath; permanence of the reservoirs which cannot be burned out, as can the steam boiler, and which cannot be injured by the corrosion due to leakage of water and steam, which is so serious a cause of injury to the steam boiler. The engineer appreciates the latter points particularly, as well as the comfort of having no fire or fireman to look after and to distract his attention from his duties at the throttle, and ahead of the train. He is even saved the responsibility and taxation of "looking out for the water" in the boiler, which is no small matter on the steam locomotive.

Comparing the commercial sides for the two motors, the air locomotive will undoubtedly be found to cost much less for repairs, to lose vastly less time in the shops, and to demand very much less of the time of the engineer and of the master mechanic, when off the road. Whether the cost of running will be so small as to permit the adoption of the system on our elevated railroads, and other railroads to which it may be as well adapted, cannot, as a matter of course, be certainly known until the experiment shall have been tried under all the best conditions for its operation. This, is in fact, the question to be determined. The experiment on the New York lines is evidently very encouraging; and it is to be hoped that the very favorable estimates offered by its promoters may be confirmed by long trial, and the successful introduction of the motor. So far as we are aware, the compressed air locomotive has hitherto been used only where, as in the longer lines of tunnels, there existed peculiar reasons for its introduction. The experiment is a perfectly legitimate one, and the new company are entitled to every favor that can be properly accorded those who attempt in any way the ameljoration of the annoyances and the dangers of railroad travel.—*R. H. Thurston.*

### A Barometrical Electric Alarm.

Mr. O. H. Christensen, of West Cowes, England, has patented an invention which consists of an adaptation of electricity to barometers in such a way that when a fall takes place the instrument itself sounds the alarm. With the aneroid barometer the index, which is set by the observer, is placed below that indicating the pressure of the atmosphere, and when a fall takes place the two come in contact, and an electric circuit is formed, which causes the alarm to ring until the circuit is again broken by the separation of the indicators.

### Electrical Surgery.

A few days ago a boy named Ulmer, in Portland, Me., got a piece of steel into one of his hands. A surgeon examined the wound and decided that he would have to cut the hand open for two inches to extract the piece of steel. He first took the boy to the Western Light station, and tried the value of electricity as a surgical aid. The piece of steel had gone down through the hand. A steel instrument was inserted into the wound until it reached the piece and the instrument was then magnetized, and drawn from the wound, drawing the piece with it, leaving only the small hole where it had entered to heal, and thereby saving the usefulness of the hand.

### Water Power in America.

The extraordinary development of water power for economic purposes is an American idea. In no other country has it been so extensively and so successfully utilized. This will be apparent by considering some of the rivers which have been dammed for the benefit of mankind, and the force which they furnish reduced to the standard of horse power: The Passaic, at Paterson, New Jersey, 1,000-horse power; the Merrimac, at Lowell, 10,000; the Mohawk, at Cohoes, 14,990; the Connecticut, at Hadley, 17,000; the Androscoggin, at Lewiston, 11,000; the Housatonic, at Canaan Falls, 3,000; the Mississippi, at the Falls of St. Anthony, 15,000; the Oswego, at Oswego, 4,000. The sum total of these is 75-000-horse power, as estimated at a given point on each river. But this is used over again on an average not less than three times. This would show a larger total of 225,000-horse power. There are also very many smaller streams in all the hill sections of the country which are utilized and may furnish, used and unused, power equal to the last-named total of 225,000; thus giving a grand total of 500,000-horse power, distributed over a wide extent of country, and supplying, in their way, the wants of 50,000,000 people.

But these are only the minor powers, so to peak, of the hills and valleys. The grand dominating power that could absorb them all and still have room to give hospitable refuge to four times as many remains to be noticed. It is the Niagara river. From data furnished by the United States Lake Survey Bureau in 1875, it appears that the average flow of the river above the Falls is 10,000,000 cubic feet per minute. Converting this into horse power under a head of 200 feet, we have a grand aggregate of 3,000,000-horse power—a mighty force that would supply the economic wants of 200,000,000 of people.

### Letters Patent as Assets.

By a decision of the Supreme Judicial Court of Massachusetts, letters patent belonging to a firm are to be dealt with on a dissolution of the firm like other partnership property. That which was partnership property before the dissolution continued to be so afterward, and a sale of the whole personal property will be ordinarily enforced by a court of equity and an account ordered of profits made since the dissolution. The surviving partner is not allowed to divide the property in specie, or to take it himself at a valuation, or to have its value ascertained otherwise than in a sale, but he must turn all the assets into an available or distributable form, so far as this can be done.

### Standard Electric Time.

The Time Telegraph Company, of New York, is the only corporation organized for the purpose of furnishing throughout the United States a comprehensive and perfect working system of standard time. It owns valuable patents covering the system, and the Rhode Island Electric Company own the right for New England.

An electric clock regulator, without weight or spring, at a central office, is connected by wires with as many dials or regulators within a square or circuit as may be desired, and the hands of such dials are moved by electricity in synchronous movement with the regulator. Thus every dial placed shows absolutely correct time, as the regulators are controlled by the Cambridge Observatory time, which is connected with the system at the Western Union Telegraph office.

Over 300 dials and about 40 regulators are now working in Providence, R. I., and giving great satisfaction. A small rental is charged for the dials. The regulators are mostly used by jewelers and in public offices.

### The Advance Made by the Hartford Electric Light Company.

The day for the illumination of the main streets of this city by gas has passed. The yellow, flickering, inadequate light has given place to the rich, clear, mellow refulgence of the electric arc. Instead of suffering disfigurement by the traditional lamp-post and lantern brought close to the walk, our thoroughfares are ornamented by the posts and carbon points of the new régime. The introduction of the electric light met with sturdy opposition at first by the court of Common Council—urged thereto by the gas interest—but it is safe to say that the city fathers have become strong and lasting converts to its desirability. The lights have vindicated themselves. They furnish better illumination and more of it, at the same expense, than the gas service was even suspected of doing. Experience thus confirming promise and anticipation, favorable judgment must ensue. There is but one sentiment among unprejudiced citizens of Hartford: the electric lights must be continued and their number must be increased.

Each electric light displaces six or seven gas lights, and displaces them so effectually that even more light is obtained—say ten times more than before—and at no additional expense. It is a matter of history how excellently well these thirty lights were received. They have changed the entire night aspect of the main thoroughfare of our city. Pedestrians and storekeepers have rested more securely, knowing that the dangerous classes flee from well-lighted streets. It was in essence an addition to the police force A prominent householder who had been up in arms against the innovation, so acknowledged it. From a remonstrant he was converted into an importunate petitioner.

These thirty lights were ordered May 30. In June six more were ordered, and Monday night the Council, keeping a view of the progress already made, passed an order for thirteen more. Petitions for thirty additional were presented and referred to the Street Commissioners. This total of seventy-nine will probably be increased to 100 by December next.

The Hartford Electric Light Company is showing a close acquaintance with the business. Its methods are economical—as they can be under the American system it employs—and thorough. It furnishes the maximum of power with the minimum of expenditure. It is surprising that the old systems were operated as well and as long as they were. They were ill-digested schemes, and very wasteful, too, with absolutely nothing, save noveity, to commend them. But the Thomson-Houston machine, with the Armington & Sims engine, is unsurpassed in its economy and its execution. To this improved method, as well as to the business qualifications of the managers, is due the success of electric illumination in this city.

The construction company, by which the Hartford or sub-company was established, is the American Electric and Illuminating Company, of Boston. Managed by experienced gentlemen, this organization has had a phenomenal success, and has deserved it, too. It takes the sting from envy when success is fully merited. Under the presidency of Mr. Edward H. Goff, and with an able board of directors, including a number of Connecticut gentlemen, it has in a year and a half become completely established, declaring no less than a twelve per cent. dividend! All this is due to the superiority of the American system—Thomson-Houston machine and Armington & Sims engine. The company has equipped valuable stations in many large New England and Canadian cities, and is constantly enlarging its usefulness. Having recently added to its patents and territorial rights, it has now for its field nearly all the country this side the Mississippi. In view of the enlarged domain, an issue of $100,000 additional of preferred stock has been voted and is now being disposed of at par. In the success of the construction company and of its various plants—especially that in Hartford, of which we speak from a minute acquaintance with the facts—there is a new augury for the success of ingenuity and perseverance in every branch of industry.—*Hartford Post.*

## ELECTRIC LIGHT NEWS

—— We learn that the Brush Company, of London, have just supplied, to the order of the New South Wales Government, one of their $D_2$ L-sized "Victoria" machines, in which the field magnets are wound on a patented system devised by Capt. P. Cardew, R. E., of Chatham, which enables the machine to be used for arc, incandescent or search-light lamps, as required. By means of a switch-board affixed to the machine, the coils of the field magnets may be connected up in a variety of ways to enable the machine to do different kinds of work. First, by a certain combination of the coils, it is possible to run four powerful arc lamps simultaneously parallel, or, if required, any lesser number; the difficulty of being able to work arc lamps economically in parallel circuit has been surmounted by means of this method of winding. This arrangement, at the same time, permits of any of the arc lamps being worked independently of the other. By simply altering the connections, the machine may be used for working a single powerful hand-regulated search-light of 25,000 candles, suitable for naval or military purposes. By another combination, the machine may be made to work 125 twenty-candle power 60 volt Victoria lamps, and being self-regulating these can be turned on or off at will without alteration being made in the speed of the dynamo. Another most important combination, which can be effected by Capt. Cardew's winding, is that of satisfactorily working arc and incandescent lamps in parallel simultaneously.

—— An electric light company operating the Thomson-Houston system has been formed at St. John's, N. B. The St. John's Electric Light Company is organized with a capitalization of $100,000. A reserve of $20,000, or 2,000 shares, are placed in the company's treasury for enlarging and developing its business. The company is now firmly established. The demand for electric lights has far exceeded the expectations of the management; everything now indicating that a plant of 200 lights will be required within one year from the date of starting. Temporary power is now being used at the St. John's Bolt and Nut Works during the time necessary to erect a central station, which will be adjoining the works. This station will be built of brick, 100x40 feet, two stories high; engine and dynamo room, 40x60 feet; boiler room, 40x40 feet; with offices, workshop, storeroom, and sleeping rooms for workmen will be in the second story. The company will have two boilers of 100 horse-power each, and two engines of seventy-five horse-power each. The whole so arranged that any additional power that may be required can be added at any time. In order to carry out the plans for an enlarged business, the company is now offering a small amount of its stock for sale at $10 per share for the payment of plant and station. This company, having acquired the right by license from the Royal Electric Company, of Canada, is the parent company for the Province of New Brunswick, and now ready to enter into contracts for constructing and building central lighting stations for cities or towns in said province.

—— That electric light stocks are remunerative as an investment, we quote the following from the Boston *Globe:* "The rapid development of electric light business throughout the United States is attracting the notice of capitalists generally, as a chance for a legitimate investment above the average business investment of the present time. It is said that the original investors in many electric light companies are getting forty per cent. on their stock. The New England companies have paid ten per cent. since their organization."

—— Wilkesbarre, Pa., is now lighted with a thirty arc light Brush plant.

—— Binghamton, N. Y., has decided to have a Brush installation of twenty arc lights.

—— The Grand Opera House, in Paris, makes use of a gas engine to supply power to its electric light system.

—— The United States Electric Lighting Company has declared a dividend of five per cent., payable August 1st.

—— Geneva, New York, will introduce the Brush-Swan system during the month of July. Both incandescent and arc systems will be used.

—— The electric light has been recommended as a head-light by the Government of Austria. The railroads are all operated by the Government.

—— Hoboken, N. J., will be illuminated with the Thomson and Houston systems of arc lights next month, the Common Council having granted Pope, Jewell & Co. the franchise and rights of way.

—— Mr. Ed. Raphael, of Houston, has succeeded in establishing a large plant of United States lights in Houston for street lighting, much to the dismay of the local gas company.

—— The Woodhouse and Rawson incandescent lamp has not been sold, we are informed, to the Phœnix Electric Company. The patents on this lamp for this country are owned by Woodhouse and Rawson, Engineers, London.

—— Messrs. de Meuron and Cuénod, of Geneva, Switzerland, have just completed the installation of a very important electric power plant in Biel. A water power of 30-horse is transmitted a distance of 4,000 feet through a copper wire. The dynamos are of the Thury pattern, revolving at the rate of 400 to 500 times per minute.

—— Gas lamps (400) in the grounds surrounding the Capitol, Washington, were recently extinguished, while the electric lights were lit, and the engineer in charge of the grounds says another hundred in the adjoining streets and avenues could have been dispensed with without any difficulty. During the past week, a single lamp with reflectors behind it, to throw its rays directly through Pennsylvania Avenue, was placed on the roof of the building, and the result was in the highest degree satisfactory; vehicles and pedestrians were easily discernible, and even the railroad track could be seen the entire distance between the Capitol and the Treasury Department, a distance of a mile and a quarter.

—— An exchange says that recently a new iron steamer, with an electric attachment, for fishing in the Java seas, was thoroughly tried on the Clyde, and the result was up to the most sanguine expectations, and she has started for her destined arena. She carries a powerful submarine electric arc lamp enclosed in a water-tight casing of glass, as a mode of attracting fish and catching them by means of nets. This is the first application on a practical scale in Great Britain of the electric light to such purposes. The lamp is very strong, being 15,000 candle power. In the test the submarine lamp was lowered into the sea some few feet below the surface, and subjected to a four hours' continuous working trial. The engine and dynamo, which are placed in a convenient corner of the engine room, made a speed of 700 revolutions per minute, with the result of a perfect illumination of the sea for a considerable distance around the lamp, which, as the darkness of the night came on, had a very novel and striking effect. The trial was over at 10 P.M., when the lamp, still burning brilliantly, was hoisted up from the deep and found to be working in perfect order. It is said that this will revolutionize deep sea fishing by insuring immense fares at a slight expense and with only slight risk of life, because of the almost perfect seaworth of the ship, a very important consideration, which must in time win the approval of fishermen.

# ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JUNE 24, 1884.

300,781 Static compensator for telegraphs; Francis W. Jones, New York, N. Y.

300,821 Dynamometer; Andrew Wilson, New York, N. Y.

300,827 Electric motor; Wellington Adams, St. Louis, Mo., assignor to the Adams Electric Company, same place

300,828 Electric motor for railway cars; Wellington Adams, St. Louis, Mo., assignor to the Adams Electric Company, same place.

300,835 Dynamo-electric machine: John B. Blair, Chicago, Ill., assignor to the Blair Electric Company, same place.

300,859 Transmitter for printing telegraphs; Stephen D. Field, New York, N. Y., assignor to the Commercial Telegram Company, same place.

300,933 Secondary battery; George L Winch, Madras, East Indies.

300,976 Telephone call annunciator; Charles W Howard, Neenah, Wis.

300,999 Arc lamp; Francis Murray Newton, Belfast, county of Antrim, Ireland.

301,023 Electrical circuit breaker; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,024 Manufacture of carbon conductors, Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,025 Dynamo-electric machine; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,026 Connector for electric conductor; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,027 Dynamo-electric machine; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,028 Electric regulator; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,029 Junction device for electric circuits; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,030 Safety strip for electric circuits; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,031 Electrical conductor; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

301,059 Electric valve for regulating temperature, etc; Warren S. Johnson, Whitewater, Wis., assignor of one-half to William Plankinton, same place.

301,076 Electric arc lamp; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

**A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.**

**If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.**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## BUSINESS NOTICES.

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BRUSH ELECTRIC CO., Cleveland, Ohio. Arc Lights and Brush Storage Batteries.

BUFFALO ELECTRIC WORKS, Buffalo, N. Y. Carbon Points and Plates.

BUTLER HARD RUBBER COMPANY, New York. Rubber Insulators and Electrical Supplies of every description.

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CONNOLLY BROTHERS, New York, Patent Attorneys and Solicitors.

CORNELL UNIVERSITY, Ithaca, N. Y. Electrical Engineering.

DETROIT ELECTRIC COMPANY, Detroit, Mich., white oak Pins and Brackets.

D. VAN NOSTRAND, New York. Scientific Books. Send for circular.

F. E. KINSMAN & Co., New York. Imported and Experimental Apparatus, Geisler Tubes, Motors, Coils, Lanterns, etc.

HARVEY, STAFFORD & Co., Acton, Ont., Canada Telegraph and Telephone Poles.

H. M. RAYNOR, New York. Platinum for all purposes.

HOLMES, BOOTH & HAYDENS, New York. Fireproof Electric Light Wire, Patent "KK" Insulated Copper and Iron Wire for Telephone and Telegraph use. Send for catalogue and prices.

I. W. COLBURN & Co., Fitchburg, Mass. Dynamo Electric Machines.

J. O. SHIRAS, Cincinnati, O. Telephone Stocks bought and sold.

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At a meeting of the Executive Committee of the American Electric and Illuminating Co. held to-day, it was resolved that all orders and applications which have been filed with the Treasurer for the Preferred Treasury Stock of this Company at par (as advertised above, must be completed by the payment of the first installment on or before Thursday, July 10, 1884, and that no subscriptions at par be received after that date.

*EDWARD H. GOFF,*
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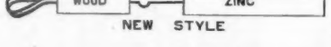


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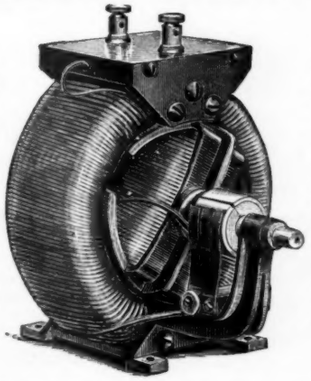

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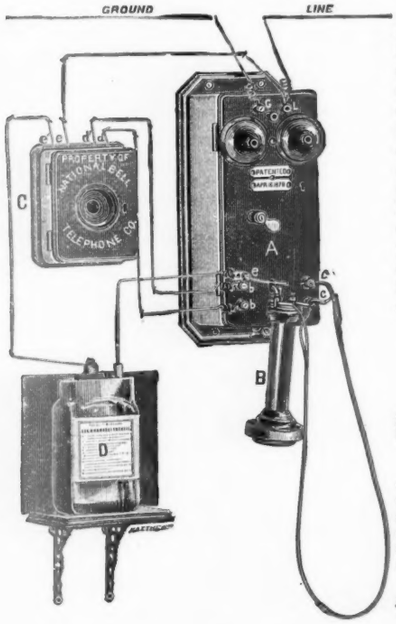


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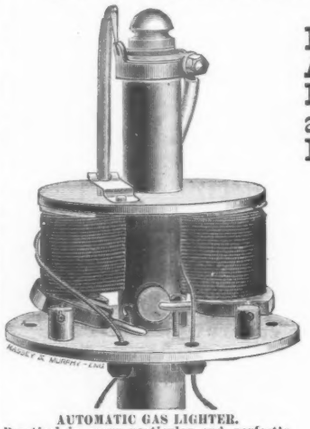
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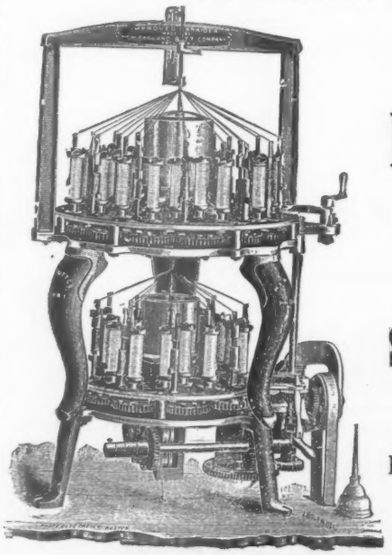

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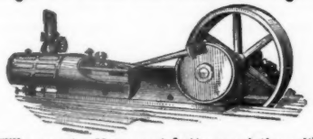

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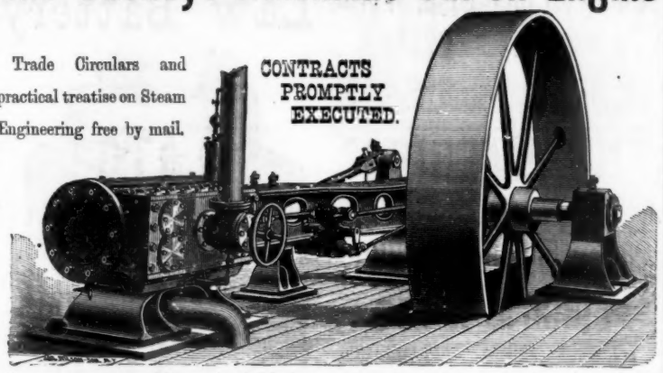

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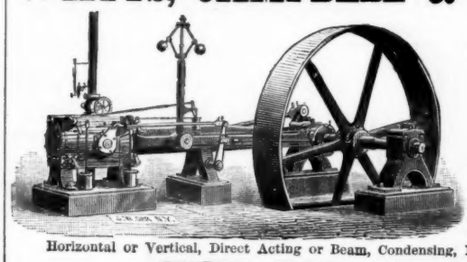

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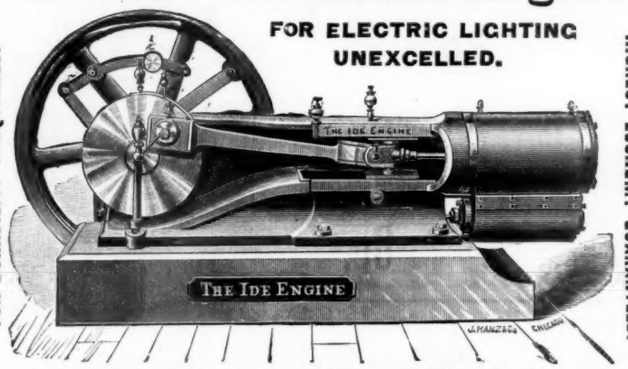


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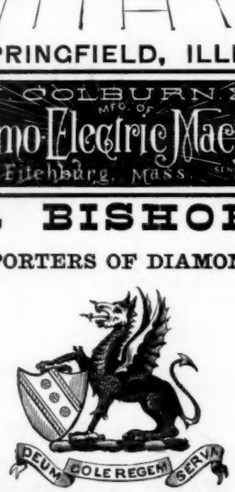


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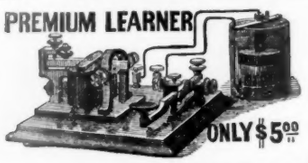


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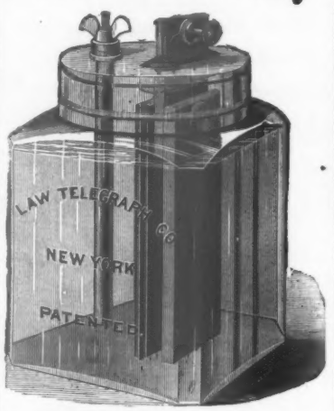


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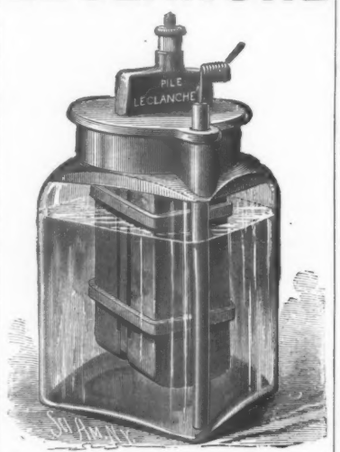


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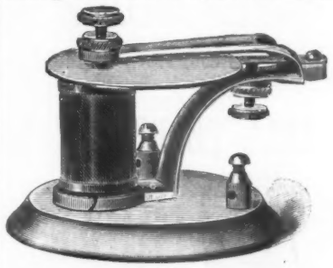

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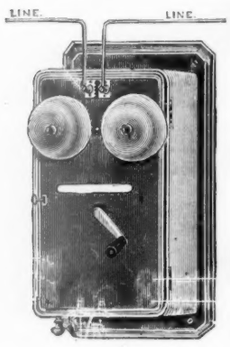


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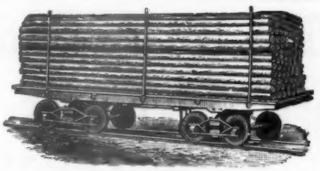

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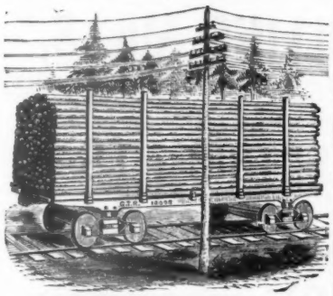

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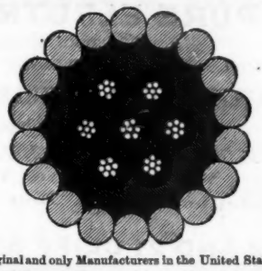

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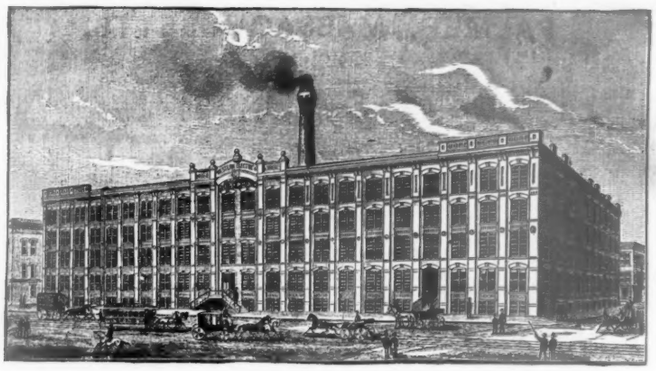

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